

Aviation Week

and Space Technology

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May 29, 1961

SPECIAL REPORT:

French
Air Show

Dassault Mirage IV





BRINGING SPACE DOWN TO EARTH

Marquardt's successful accomplishments in the aerodynamic field are supported by unique testing and laboratory facilities created especially to sustain and extend advanced research and development activities. Expanding customer requirements as well as permits testing to be performed continuously under rugged controlled conditions. When applied in conjunction with Marquardt's aerospace research and development programs, these facilities provide a complete capability for producing advanced systems of proven performance and extreme reliability.

Small scale air breathing engines and rockets can be tested to Mach 15 and 100,000 feet altitude for intervals of 100 seconds using ramjet, propellant including liquid hydrogens and liquid air. Aerodynamic models, combustion chambers and injectors, nozzles and components can be tested in the plasma-driven hypersonic test cells at intervals as long as 30 seconds at 10,000 feet per second and altitudes to 200,000 feet, or above 30% percent of the earth's atmosphere. Airbreathing engines up to 4 feet in diameter can

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AUXILIARY POWER FOR MINUTEMAN'S THREE STAGES

The U. S. Air Force's Minuteman, first of the solid propellant powered ICBM's, introduces numerous design and operational features unavailable in its first generation counterparts. One result is a smaller, lighter, less complex and lower cost missile.

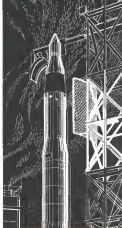
COMPACT DESIGN—Typical of these advances is the highly engineered APU design developed for all three missile stages by Vickers under contract to Aerojet, a division of North American Aviation, Inc. A significant saving in package weight and envelope is provided by inserting the hydraulic pump completely within its self pressurizing reservoir.

APPLICATION FLEXIBILITY—An important design feature is the ability of the hydraulic pump to be coupled with a wide variety of drives including continuous duty electric motor, gas turbine, hydraulic motor, flywheel, or be mounted directly on its engine drive shaft. For the Minuteman application, an intermittent duty diesel motor is used.

UNUSUAL STORAGE LIFE—A fundamental design goal of the Vickers Minuteman APU was to match the unusual storage life of the missile. This has been accomplished by providing long corrosion standby in the missile, coupled with convenient ground check-out.

HIGH RELIABILITY—The schematic diagram below shows the absence of external tubing and the requirement for only one external dynamic seal. These factors along with a proven pumping element and relative low operating speeds have led to a highly reliable system.

This solution is typical of the Vickers "Programmed Power" approach to energy conversion, power transmission and fluid transfer. Get more details on this application by writing for Bulletin A-5249.



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A black and white photograph of the Space Shuttle Challenger during its ascent. The orbiter is attached to the External Tank and Solid Rocket Boosters, with a large plume of white smoke and fire at the base.

Kidd designed and is supplying complete hydrogen peroxide reaction control systems for the second and third stages of NASA Scout and Air Force Blue Scout. Systems and components available in 10 days—not in 3 months or 3 years!

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(Continued from page 53)

[illegible]

Exploratory studies were initiated by Aerojet in 1986 to ascertain the feasibility of nuclear reactors and the technical advances required to develop a successful nuclear propulsion system were determined. This work at Aerojet has undergone continuing attention under government and corporate sponsored programs. Included are preliminary design of engines and vehicles, simulated nuclear engine tests, radiation hazards research, analog computer system design for simulated nuclear reactor operation, nuclear test facility construction, and the design, development, testing, and manufacture of reactors.

These programs have resulted in significant progress toward the development of a practical and reliable nuclear propulsion system. They are based on Aerojet's combined experience in liquid and solid propellant rockets, nuclear technology, and cryogenics—experience which assures that the challenge of a new era in aerospace can, and will, be met.

Aerojet-General
CORPORATION



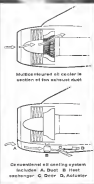
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These oil/fuel/air coolers are ready to use on Boeing 707/720 turbofan aircraft and may be shaped to any configura-

tion at extremely close tolerances. Comparable in price to conventional heat exchangers, they are even more reliable and have a longer service life because of their basic simplicity.

Unique manufacturing techniques developed at AiResearch enable thin aluminum walls of welded and all-brass constructions to withstand as

well structural and pressure loads. Similar units have been developed for turbo-gas gas turbines and ram air ducts. This major breakthrough in heat exchanger design and fabrication is the result of more than 20 years of experience by the company in the design, development and production of heat transfer equipment.

• Please direct inquiries to the Los Angeles Division.

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ELECTRONICS

G-E Five-Star tubes prove 99.11% reliable in 10,000 hour life test

Four hundred and fifty type 8529 Five-Star tubes were subjected to a DC life test to study the effects of heater voltage, heater-cathode potential and plate dissipation on vacuum tube life and reliability. After 10,000 hours of operation, failure rates were such that no statistical significance could be attributed to them. Of the 456 tubes tested, only four failures occurred: two at 3000 hours, one at 3200 hours, one at 3600 hours—despite the fact that the test parameters were purposely made severe enough to produce early failures. For example, in test lot number six, 50 type 8529 Five-Star tubes were tested

under severe conditions (elevated heater voltage, 6.5 volts, over 100 volts negative heater-cathode potential, 2.5 kV plate dissipation). There were no failures at 10,000 hours. Test data supplied upon request.

In life tests such as this, and in everyday performance, G-E Five-Star tubes prove their reliability in critical applications: airborne navigation and communication, industrial controls, radar, space navigation, broadcast. Five-Stars are not tubes selected from standard screening types. They are specially designed, specially manufactured to cope with particular electrical requirements

and withstand severe environmental conditions such as shock and vibration. Where you can't afford to compromise performance and reliability, order Five-Star tubes from your General Electric tube distributor. Distributor Sales, General Electric Company, Room 1141A, Owensboro, Kentucky.

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PAGE 40/100 • 20/10/100

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After exhaustive tests Atlantic tests aboard Pan Am's Boeing 707-321 Jet, this new system has been certified by the FAA.

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GEL's Electronic Navigation Instrument Failure Warning System is always alerted to any potential malfunctions. If a malfunction does occur, an annunciator lights, the master warning light flashes, and a siren sounds an electro-mechanical thumping or siren sound competing but not annoying sound.

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To use Pan American installation the VERBOD and OK panel is purchased for both the Captain and First Officer. The Comparative Annunciator Panel, consisting of warning lights for the compass, attitude horizon and power failure is installed between the two pilots.

If you want the full information on this revolutionary new warning device, write or call:

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TAPER-LOK washer-nut fasteners require TLD (Taper Lock Drill) tooling. This tooling is available in two sizes: 1/8" and 1/4".



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TAPER-LOK bolts should meet or exceed the following minimum requirements:

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The Challenge Must Be Met

There is increasing evidence lately that the Kennedy Administration is beginning to recognize the tremendous impact of technology on the fate of our times and is preparing to face fully the responsibility required by political leadership to make U.S. technology its keen cutting edge of an effective national and international policy.

President Kennedy observed earlier in his inaugural address that "... man holds in his mortal hands the power to abolish all forms of human poverty and all forms of human life..." but it has taken some time to fully realize the impact of this fact on the course his Administration must inevitably take if it is to stand any chance of success.

Now that he is beginning to face up to this challenge of technology as a national policy, it is incumbent on the aerospace industry to reexamine its own resources, policies and goals in order to fully and effectively meet this challenge when it is passed on to it for translation from policy to reality. Inevitably the aerospace industry will be the spearhead of this drive toward creating the strength required to maintain security from disaster, rely itself on machine maintenance and at providing the new technology required to come powered and dawning from those old and obsolete, lands that embrace the majority of the world's population.

The role of aerospace technology in welding this required strength is clearly defined and most of its massive technical drive has been directed toward this end. However, the aerospace industry has an equally important role in the campaign to social technology, to the under developed and poverty ridden areas of the world and the effort could stand considerably more emphasis. Even a person traveling barely around the globe can feel the impact of post war air transport in general and that of the giant jetliner in particular on the politics and economies of our times. In Europe particularly the twin advances of military and civil aviation have done much to dissolve years of the rigid national boundaries that retarded its economic growth for so many years. In Asia and Africa the full impact of air transport is still to come.

Future Transport Development

The aerospace industry has done a magnificent job in the post war transport field, particularly in its development of jet airliners. However, a promise along the actual bowwies of the world off the main jet routes gives evidence of how well U.S. aviation did in another work with future transport, for along all of those bowwies the old piston airliners from Santa Monica, San Diego and Burbank are still plugging their trade profitably and reliably like tramp steamers in addition to the sleek blue ribbon transatlantic liners. But now that the jet job has been largely done there must be some serious thought and effort to develop the type of air transport that can truly serve those vast areas of the world where development of aerial supply and communication lines offers the only hope of economic development.

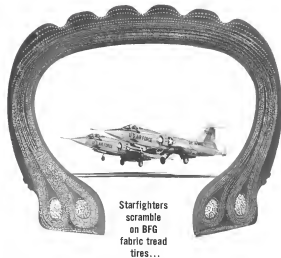
Our efforts in this area have been feeble largely because financing the purchase of this type of equipment has been difficult if not impossible for the nations that need it most. It is in this area that a new U.S. policy is needed for stimulating development of suitable equipment in the aerospace industry on the one hand and for cash long term credit for its financing by the user nations on the other. Our policy with the Export-Import Bank has been extremely effective in the long-range transport field, particularly for the high cost jets, but it has never been adequately projected beyond the periphery of almost self-developed economies. The reputation of U.S. aerospace engineers in developing the sound air transports and engines that have been the spearhead of airline expansion all over the world during the past 15 years and the reputation of U.S. aerospace business organizations supporting these transports with spares and services are national assets that should be more widely applied to the new areas where the need for swift development of aerial logistics offers the only real hope for future economic growth.

Challenge to Aerospace Industry

To meet this double challenge the aerospace industry will have to improve its technology, sharpen its sales tools and maintain an aura of integrity above its present standards. We think Joseph V. Clark, under secretary of the Air Force, expressed this problem well recently in speaking to the scientific and industrial leaders of the aerospace industry gathered in Washington to honor Dr. Theodore von Karman on his eightieth birthday. The keynote address was entitled and we quote: "I am deeply disturbed by all too frequent evidence of the technical irresponsibility of attempts to work contract gaps through deceptive representations to the military of concepts that are technically unproven or highly speculative but are represented as attainable at an early date and at low cost. I see too much of attempts to solve problems by the misuse of application of manpower rather than by the effective application of horsepower. Sometimes accomplishment seems to be measured by the size of the contracts required to complete the job rather than by the efficiency with which the job was executed. We tend to substitute glossy proposals for sound technical ideas and we often times confuse technical concepts with demonstration models. I believe we have become too concerned of sophistication and too preoccupied of complexity. The dubious luxury of these faults cannot be continued. We must focus our energies in the most efficient fashion we can, for in large measure the destiny of man is linked to how we face up to the new horizon of 1965."

We impetuously suggest that the aerospace industry take a good retrospective look at itself with a view to ward determining how it can better serve as the keen cutting edge of a new national technological policy that can support our political and economic cause powerfully against the challenge of other systems.

—Robert Hite



Starfighters
scramble
on BFG
fabric tread
tires...

selected for ability to take 2-ton load variations, speeds to 270 mph.

A few steps to the air, The Lockheed Starfighter is also mighty quick on the runway, with takeoff speeds ranging from 212 mph up to an extreme of 270 mph. The Starfighter's flexibility and capability to carry heavy loads requires tires that can take two-ton load variations, and stretch up to 270 mph under adverse takeoff conditions. The BFG fabric tread design has proved it can stand up to these punishing conditions, reducing tread cutting and making tread separation virtually impossible. Multiple nylon plies are built right into the rubber tread stack. This reduces internal tread flexing and contracting. These tires are being supplied on the F104 for the U.S. Air Force, West German Republic, and Canada. For complete information, contact B.F. Goodrich Aviation Products, a division of The B.F. Goodrich Company, Dept. AW-SC, Akron, Ohio.



aviation products

SPS announces a major achievement in aerospace fastener development...

**BERYLLIUM BOLTS
FOR PRODUCTION USE**

Available in flush and hex heads

Out of SPS Research & Development Laboratories and Pilot Manufacturing plant has emerged the world's first vehicle, *hybridus* (see below).

With a density of only .0658 lb. per cubic inch—less than one-fourth that of steel—beryllium can account for truly extraordinary efficiency in spot programs. The current cost of striking a pound of beryllium is reckoned at about \$15,000. That would be the cost, then, for a pound of steel fastener with holding power of, say, 85,000 psi in shear. But the same quantity of beryllium fasteners of equal strength would weigh less than ¼ lb. So they would cost only about \$5,750 to ship.

Further proof of bayonet's superiority as an anti riot tool today's manufacturers of the material have a sheer strength of 60 000 psi minimum. To achieve or equal their strength-to-weight ratio it would be necessary to use a heat-treated steel faster having a tensile strength of 468 000 psi. No other strength could be known—another reason SP5 development—a rate of change was very slow; however, physical science has advanced so much in research and development work over the past few decades that many of the problems posed by titanium breakdown and acid solubility, for instance, can be contained. But SP5, with fabrication techniques considered in the forensic industry, was able to overcome them. It was discovered that thermal contracting by fire the most critical area had to be relieved with a thermal stress reliever. The relief contraction was found to be a further development of the metal itself. The metal's fatigue life was increased up to 40% at a cost of 35%. The metal's fatigue life was increased up to 40%.

In new designs where weight reduction is of critical importance, Acetalatherythrum bolts—now being produced in quantity in three head configurations—"Hot Torque" flush head, "Torq Set" flush head and hex—for use in a wide variety of aircraft, missile and rocket applications. For further information, write STEELMAKERS STEEL CO.—manufacturer of precision threaded fasteners and allied products in many metals. AMERICAN METAL DIVISION, SPS, JENKINTOWN 3, PENNSYLVANIA-SANTA ANA, CALIFORNIA.

Comparison of mechanical properties—by strength-to-weight ratios	
beryllium bolts with steel and titanium bolts of MIL 488 configuration	
(Values are given in stress/density units—psi/in. per cu. in.)	
Strength of beryllium bolts	550 lb./cu. in.
Strength of titanium bolts	16 lb./cu. in.
Strength of steel bolts	25 lb./cu. in.

**SPS**

where activities replace probabilities

WORLD TO - TOWER TWO • See Page 102 • See Issues: Two • Sports West • Eyewitness N.Y.
• World: Kato • US: HRCAL • Under Metal (Kato) • H. Downloaded Web Browser

WHO'S WHERE

In the Front Office

Dr. H. Clifford Stone, professor of non-linear and ultrasonics at Massachusetts Institute of Technology, a director of Trans-Sonic Inc., Lexington, Mass.

Philip S. Fogg, board chairman, Consolidated Systems Corp., Worcester, Ohio, an associate company of Alfa Chemical, Bell & Howell and Consolidated Electro-dynamics Corp. Mr. Fogg is board chairman of CFC and co. chairman of Bell & Howell.

Frank L. Roberts, vice president and manager in the product, Sports Governance Co., Great Neck, N.Y.

James F. Brown, vice president and regional director of marketing, **Lois Inc.**, Santa Monica, Calif. and **Andrew F. Blalock**, vice president and general manager of **Lois's** *Adaptive Division*.

James E. Debusse, president, Spex, Inc., or Nations, Inc., El Segundo, Calif., division of Inki Corp.

Nelson S. Smart, president and Sam Alford, vice president, of the newly formed Rodman Andros Corp., Washington D. C. formerly with United Research Corp. Smart and Alford will specialize in economic research for business and government.

William E. Nelson, vice president and director of administration, Macdonald Inc., South Pasadena, Calif.

Mr. Robert F. Hickey, vice president sales, Los Angeles Airways, Inc., Los Angeles.

Mr. Conventrice F. E. Bickel, board chairman of A.T.S. Co. Ltd., London, England.

Mr. Conventrice Bickel, chairman of the

As a consequence, these customers in the strong division of Blackhawk Engines, Ltd. A.T.S. will provide Hawker Siddeley Australia customers with technical information in the aerospacel field.

Charles E. Chaney, president, Strong to Strong Corp., Lansing, Mich., a subsidiary of Carter-Wallace Corp.

Artista Di Pasquale, constant case present personnel, field activities, and research American Airlines, the John J. Gitter's records Mr. Di Pasquale is director of labor relations.

Donald W. Beach, assistant to the vice president, Teknosparking Corp.'s Electronic Systems and Value Engineered Products Division, Los Angeles, Calif.

Mr. Gen. D. C. Donahoe, commander,
Korn, Air Development Center, Air Force
Systems Command, Griffis AFB, N. Y., as
of July 1.

The following Royal Air Force appointments made have been announced: Air Vice-Marshal Charles Wroughton, director-general of operations in Ministry of Air Force and Air Transport.

stepped. Footlock, Sweden. Sjöström was on staff officer, R.M. Transport Command, Air Vice Marshal John Gerard Willsley. Willsley, director general of housing for Ministry of Air Commodore Peter Theodore Philipps, senior directing staff of the Imperial Defence College.

Robert W. Lundin, 7 vice president, The Electrode Corp., Culver City, Calif., and general manager of the Electrode Division.

INDUSTRY OBSERVER

• First attempt to create a novel type of communications satellite by placing millions of tiny transposable dipoles in low altitude orbits will be made within 60 days by the Air Force Program known as Project Winfield, formerly was called Project Noodles (AW Sec 19 p. 30).

■ USAF expects to buy uncontrolled, air-to-airportable sensors and approach sensors and single channel radar equipment this year in an attempt to improve global air capability. It also has awarded study contracts under the Enterprise Mission Support System (EMSS) program to determine what types of sensor systems are needed for the 1995-75 period. EMSS is directed by Cambridge Research Laboratories and Electronic Systems Division and its contractors include Airborne Instruments Laboratory, Alpha Corp., Avco, Garrett, GE/ILSI, Honeywell, IBM-Sage, ITT Laboratories, Lockheed, Mensor, North American and Radar Corp. of America.

► Flight characteristics of the North American B-70 bomber will be demonstrated as early as possible by flying the first model and then returning it to static test status.

► Prototype of the National Aeronautics and Space Administration's Great Observing Observatory (GEO) is scheduled for assembly early next year and flight models are to be assembled by the middle of 1992. Satellite will carry a 36-in. reflecting telescope and have a 100-min. orbital period.

► Development problems with redundancy in the internal avionics for National Aeronautics and Space Administration's Titan weather satellite have delayed launching of Tico III from the second to the third quarter of the year. Backup launch attempt would be made before the end of the year if first attempt to launch Tico III failed.

■USAF has asked Hercules Powder Co. to investigate propellant burn problems for the manufacture of Minuteman third-stage rocket motors. Hercules now runs the dry cast section for this motor.

► Use of a large, solid propellant booster, plus the Martin Titan II as a launcher for orbital Dyna-Soc flights is being considered by USAF. Titan II also a liquid hydrogen based engine stage also has been assessed.

• Deficit in the procurement of naval aircraft for aerial replacement will result in an increase in sea-war-old aircraft from 25% on June 30 to about 50% by the end of 1965. Average expected life of a naval combat plane is five years.

► **Arise!** I newspaperman Richard Cusanski is accepting bids on a contract to study ways of substantiating allegedly defaming structural members for the troublesome bridge in Baltimore's inner harbor. Simplification studies are considered the first step in setting the number of heavily loaded, duct vulnerable members that have been a prime source of measurement problems.

► Experiments for the S-85 astromorphic laser satellite, to be launched from Wallops Island, Va., in about a month, will be wrapped around the final stage of the Scout launch vehicle. The 115-lb payload is intended to orbit from 250 to 740 miles on.

• **Solar energy power supply** is programmed for NASA's Gemini and Saturn-launched payloads for missions planned through 1965. Meanwhile, Hughes Aircraft is evaluating the use of radioisotope thermoelectric generator (AW Apr. 17, p. 21) for possible use in Saturn's lunar payload after this has been well tested.

• Portion of the \$115 million in operating funds reported by Navy for the Pacific Missile Range for Fiscal 1962 will be spent to convert a Victory ship hull into a large construction shop.

* Television camera is under development for a NASA Mars probe, along with microscopes and sensors and electrical field instrumentation.

2%

pinpoint

& NASA

payload



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systems

reliability

CALTECH'S JPL BANDER,

to carry research instrument packages to the moon, will rely upon precision design, construction, testing and performance of Motorola electronic equipment. Comprehensive measurements of operational and navigational data aboard will be assembled for transmission

by its Flight Data Encoder. An all solid-state Transponder generates the telemetry carrier, receives ground commands, and translates carrier frequencies for two-way Doppler velocity measurements. In its laboratory and at launch site, Payload Test Bed will check out the spacecraft RF communications system. At NASA's transmitter and receiver sites, Caltech's Beacon will check command transmitter performance and radiate pseudorandom signals to test telemetry recovery. Motorola's participation in Ranger lunar probe demonstrates its space communications capabilities for frontier programs.

Military Electronics Division



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Washington Roundup

Arms Control Action

Kennedy Administration is expected to launch a major scientific and technological program to develop detection and monitoring systems for all types of weapons. The President has long felt that this is the key to any realistic arms control program. Work will be devoted to a new executive agency—probably a semi-autonomous unit within the State Department.

State officials authorizing the new agency now reportedly submitted to the President last week by John J. McCloy, his departmental boss. It already has been reviewed by top officials in other departments that would be affected.

Space Task Group, the team that directs manned space flight projects for National Aeronautics and Space Administration, may be moved from Langley Field, Va., to Houston, Tex., or Tampa, Fla., so that it would be closer to the space shuttle launch sites.

A move to Texas might make Vice President Lyndon Johnson, who heads the National space council, a target for criticism. But NASA believes that more complete acceptance of space costs—already paid to \$5 billion annually with a credit lower program—depends on a report of findings.

The task group reportedly fought a plan two years ago to shift it to the Goddard Space Flight Center near here. Earlier this year, STG was increased to the status of a manned space flight center and it was thought that it would report to Ames Research Center in California. If the group goes to Florida it would use the decommissioned McDonnell Aircraft Co. now in Texas as a probable new site.

Apollo project team, which NASA says is increasing from 75 to 375, could relocate at any time but the 700 members of STG now working on Project Gemini probably would not be transferred until the current orbital program is completed next year.

Tri-Service Fighter

Tri-service tactical fighter recommendations prepared by a Defense Research and Engineering Office committee were forwarded to Defense Secretary Robert McNamara last week. The committee's report would be made available for study by the Joint Chiefs of Staff. McNamara's report would be made available for study by the Joint Chiefs of Staff. McNamara's report would be made available for study by the Joint Chiefs of Staff.

Partly because he has been criticized for bypassing the Joint Chiefs of Staff, McNamara has sent the recommendations to them. Now, still seems to develop its own tactical fighter, and regardless of what new development is decided on, an interim purchase of some existing tactical fighters is still planned.

John A. DeLoach, chief of special operations, has spent so much time around the White House recently that he is expected to be named as President John F. Kennedy's successor in World War II.

Look for more changes in the Defense Research and Engineering Office in spite of the opposition from the Joint Chiefs of Staff.

Latest shift is the abolition of assistant secretaries for naval and tactical systems and creation of an assistant secretary for tactical systems. Dates of this office include growth and counter-growth warfare systems.

Frank A. Porter, who held the postwar weapons job, heads the new office. F. W. Webb, who led the tactical job, has left government service.

Oceanography Spurred

Congress is pressing for a "road map of the sea" on the theory that this may become the decisive battleground. President Kennedy earlier this year announced the fact that "we do not have adequate charts of more than 1 or 2% of the ocean." A bill authorizing the Coast Guard to perform charts and other oceanographic work, which no one would expect to be passed soon, and more oceanographic work, is coming from the Congress. These actions follow passage last year of a bill authorizing the Coast and Geodetic Survey to work on the high seas instead of being confined to within three miles of U. S. shores.

Some lawmakers and Administration officials are fervently hoping that Rep. Victor Anderson's proposed "Star of Hope" satellite never gets off the ground. It would be a satellite that would be launched around December and broadcast from a station in various languages from world leaders.

Caltech is working on proposals and other problems, but Anderson told Aviation Week he understands it will build a satellite for the industry calling on the President to accept the satellite and he will ask Senate space committee Chairman Robert Kerr to introduce a similar resolution in the Senate.

—Washington Staff



FIRST PROTOTYPE of Pater-Fleischel C.M.191 executive turboprop transport is shown at Paris Air Show profile of Hispano-Flying boat with a retractable wing. Aircraft, which has not made its first flight, is an outgrowth of the two-place Pater-Fleischel transport prototype. Two-place C.M.191 has a maximum speed of 304 kt., a 4000 wing tank, maximum range of 1,115 mi. with turbo-

European Aircraft Industry Shows Post-War

By Cecil Beaumont

Paris—Resurgence of Europe's postwar aviation industry and its increasing ability to stand on its own in the design and production fields is reflected in the display and exhibits of the 20th Paris International Air Show.

Fourteen nations are represented at the show, including the Soviet Union and Czechoslovakia, the two industrial powers of Eastern Europe, and over 90 different types of aircraft and helicopters are scheduled to take part in the flying demonstrations during the final two days of the show—June 3 and June 4. Of these, more than 60 were produced in Europe, although some are based upon United States designs, particularly in the helicopter field.

The show, which opened late last week at Paris Le Bourget field, has a total of 312 individual exhibits, a 10% increase over the last display in 1955. These have controlled by approximately 20% more space to show their latest—1,250,000 sq. ft.

Political pressure, however, interfered to control the scheduled high point of the exhibit, which also would have provided the show with its most tangible association with the space age.

The Union Sovietica des Industries Aeronautiques trade association of the French aviation industry and sponsor of the show, had invited Soviet Communist Maj. Yuri Gagarin and American Astronaut Col. Alan Shepard, the first two men into space, to appear at the show on May 31, a day devoted to space, to hold a joint press conference. Both had accepted before French poli-

tical circles learned of the bids and ordered the invitations withdrawn since their arrival in Paris would have coincided with President Kennedy's visit to President de Gaulle.

The Soviet Union, however, will still be caught representing, sticking to its trademark propaganda approach of exhibiting only positively selected air or astronautical items. The Soviets are scheduled to show three transport descriptions of which are making their first appearance in the West.

None of the lot is the Tupolev 124 medium-range transport powered by two Soloviev turboprop engines and with an estimated maximum speed of approximately 420 mph. Other new aircraft in the Avion 24, which also is used as a delivery and troop transport, powered by two turbojet turbo-

prop engines producing an estimated 2,800 city each. Also scheduled for display is the Sikorski HO 4U helicopter with four turbojets of approximately 4,000 city each.

Newest aircraft of the East nation on display—a joint development with Czechoslovakia—is the first prototype of the Pater-Fleischel C.M.191 four-place executive jet transport, an outgrowth of the high-altitude Pater-Fleischel transport C.M.173 trainer.

Presented by two interests satisfied 1,015 lb. four-place Turboprop Mustang 6 powerplants and scheduled to sell for an estimated \$275,000, the C.M.191 was intended to the show from the Hispano factory, where it was built and presently has been flown long time.

On static display in the form of the Hispano exhibit, the aircraft will begin its flight test trials immediately after the show.

The aircraft, when equipped with two optional wing tanks at 57 U.S. gal. each, has a projected maximum range of 3,115 mi. at an altitude of 28,500 ft. Maximum range without wing tanks is quoted at 975 mi. Also maximum speed is quoted at 354 kt., cruising speed 375 kt. With the 57-gal. tanks installed, the aircraft has a maximum speed of 367 kt., a cruising speed of 354 kt.

The newest French aircraft on display are clustered around the general aircraft field in the industry, making a serious effort to compete in performance and price with U.S. counterparts and to 85 an existing type. Aircraft on display include:



FUSILAGE MOCKUP of the Bristol 842, powered version of the 940 S2DL cargo-transporter transport (AWM 35, p. 36), is on static display. Now beginning its flight trials, the 941 was not scheduled to participate in the show.

Resurgence at Paris Air Show

•Gordun C-75 56 all-terrain four-place helicopter that sells for approximately \$15,200, including rotor and Pater-Fleischel. With a maximum gross weight of 2,264 lb., the C-75 56 has a maximum sea level speed of 165 mph, a cruising speed of 175 mph at 6,500 ft. with 740-hp power. Standard powerplant is the 175-hp Lycoming O-325-A engine, but a 160-hp. 8-cylinder also can be installed. Maximum wing refueling reserves is about 734 mi. Gordun is currently negotiating with a U.S. firm for rights to American and sell the four-place aircraft there.

•Messerschmitt 860 Ralle. Although the French prototype of the Ralle, with a radio control column rather than the conventional stick, that constructed the earlier models is only scheduled to make its first flight this week. Messerschmitt 860 is already in 150 firm orders for the Ralle-144 is lowest, 381 in 31 other countries. The company plans to reach a production rate of 10 aircraft per month in August and plans to 60 per month next month. The all-metal two-place craft can be fitted with either a 950- or a 145-

hp Continental engine. For the quad-engine-powered version, maximum speed is 131 kt., cruising speed 100 kt. and maximum speed 500 kt. The larger super Ralle has a maximum speed of 124 kt., cruising speed of 113 kt., range across the ocean. Fourth prototype is scheduled to make a sales tour of the U.S. after completion of flight trials. Extended U.S. sales price is \$5,995 for the 145-hp version, \$1,700 for the 105-hp plane.

•Max Anders 250 Super Bismarck Aerobike. With a tentative factory price of \$221,000, the company says it now has options for about 50 aircraft, including a smaller, Australian order. Powered by two 1,000-hp. Continental Turbine 4 turbojet engines, the four-seat transport Super Bismarck has a cruising speed of 210 kt. and can climb a 14-ft. altitude 1,040 ft. from the start of takeoff until. Plus for a six-day-a-week of the aircraft designed for the M11 150 engine and powered by two 735-hp. Continental engines is under study.

•Stander M11 145 Ralle. Ralle, a four-seat low wing monoplane with retractable landing gear and powered by a 145-hp Continental engine, still had not made its first flight early last week, although it was originally scheduled to begin flying last fall. Standers, last week, hopes to fly the plane in Le



Increased Apollo Appropriations To Accelerate Design, Hardware

Washington—Price tag of \$20-40 billion put on the manned lunar landing program includes the complete cost of the Apollo project, a substantial portion of the Saturn development program, development of advanced spacecraft and components plus construction of new launch and tracking facilities.

Some potential prime contractors of the Apollo and lunar landing vehicle spacecraft stage that the cost estimate is too high, and the lighter satellite maneuvered by the National Aeronautics and Space Administration too conservative. NASA greatly underestimated the cost and size of the Apollo program, because and built on solid ground with the projected figure for completion of the manned lunar landing program.

As the step immediately preceding the lunar mission, Apollo 11 spacecraft development has a cost estimate ranging from \$780 million to something more than \$1 billion. This figure does not include lunar vehicle costs, which could mean that double the estimate.

First-stage of the first S-1 Saturn launch vehicle has been committed to Apollo development and operational flights. Subsequent spacecraft will be flown on eighth and ninth Saturns, and the first prototype lunar flight on Saturn No. 11, now planned in 1965. NASA has ordered 10 C-1 Saturns and one C-2 Saturn for Apollo.

A DIX presents for the manned lunar landing program means NASA can speed.

• Contact award for detailed design

and hardware. Under the present plan, this award was to be in January (AW May 22, p. 24).

• Crew selection, and determination of the scientific disciplines in the three main areas.

• Development flights not scheduled to be made over a two-year period from 1963-1964. Manned flights will begin in 1966-67 under the accelerated landing schedule.

Prime Contracts

NASA aims attempt to expedite the program by awarding several prime contracts, possibly one for the stage, another for services integration and others for major systems. Single prime contractor was selected for the Mercury capsule.

Consolidated Aerospace, General Electric, and Martin Marietta, Apollo launch studies recently completed, suggest several alternative configurations, but would almost none fitting bodies. The proposals and photographs have been classified secret by NASA.

The three companies recommended use of the modular concept, with command, propulsion and service systems, and that mission stage systems be linked with liquid oxygen-hydrogen to design.

NASA awarded the spacecraft must be capable of two-week to two-month earth orbital missions, and the crewed lunar system recommended in the study contracts call for atmosphere ranging from 2,000 psi during the entire period. The Mercury mission

central system operates at 5 psi.

Number of flights proposed ranges from 25 to several dozen, all based on Saturn for manned missions.

Martin has independently proposed that Titan II be used for early Apollo flights.

Spacecraft pod weights range from 18,000-20,000 lb. Lengths are about 18 ft, and maximum diameters, 14 ft, so that they can be accommodated on the Saturn S-IV third stage.

NASA Administrator James E. Webb said last week that the agency will recruit new astronauts for the Apollo program, but properly officials say the selection phase has not yet been considered. NASA would like to keep all seven Mercury astronauts for Apollo, for their engineering and space flight experience. All are career military officers.

Although the Mercury astronauts are engineering test pilots, it is probable that useful and physical disciplines will be represented in Apollo crews.

Charyk Presses For Space Simplification

Warning that the nation's resources are not adequate to cover all the "ambitions of the widest minds" in space projects was issued by Dr. Joseph V. Charyk, under secretary of the Air Force.

In a speech delivered in Tamm, Calif., Dr. Charyk stated that space technology may open completely new fields of military operations, some of which could well be decisive in our national security.

"It becomes vital that we move forward on this new frontier with vision and with foresight," he said. "It is, however, a field of endeavor where we must plan very carefully. We want to avoid the danger that from fancy, promise, hype and technical feasibility, from scientific thinking."

Little has been achieved in military and scientific in the total space effort, he said. "I am afraid that we have been overwhelmed by speculation and discrimination. Very few of the satellite systems that we launch have very many users, even the most basic thing is practically a new experiment, and as with it, it is not too reasonable to expect that the same phenomena is normally not in complete accord with expectation."

In defining goals for space, Dr. Charyk said that simplicity and simplicity are the most important factors that bear on the problem. There are too many different types of boosters and upper stages and these have been different from one thing to the next. Dr. Charyk said.



Hiller, Bell Proposals Win Army LOH Competition

Hiller Model 1100 (above) and Bell D21E design proposals, recently selected by the Army as the best of 12 proposals submitted for the Army Light Observation Helicopter (LOH) competition (AW May 22, p. 29), are shown in full-scale models. Below: prototype of each aircraft will be delivered within 15 months to Ft. Rucker, Ala., for evaluation by the Army Aviation Board.



Germans Build High-Altitude Glider

West Germany's equivalent of the Lockheed U-2, a high-altitude powered glider is being completed for transport studies by Mercedes-Benz for the German Air Force. First flight tests are scheduled for late this year.

The two-man crew will be able to sit at altitudes up to 60,000 ft. for two hours out of a total flight plan of seven hours' maximum endurance with range up to 1,000 mi. About 450 lb. of instrumentation can be carried as payload.

Primary mission—study of the structure and turbulence of jet streams—dictated the design load factor of 1.5. Details of the aircraft is an automatic flight control system that the aircraft can fly itself, not solely under the influence of turbulence.

Secondary mission: satellite radiation measurements, photography, meteorological work, and other tests which require a vehicle of this type.

Prototype for the aircraft is a Fiat & Whitney JT12A-6 helicopter fitted at 14,000 ft. on level static thrust. The straight wing has a span of about 180 ft., an area of about 550 sq. ft., and a weight of 15,000 lb. Gross weight at stall is about 7,500 lb., which gives a stall wing loading approaching 14.6 psi.

Crossed-flight length is about 75 ft. The two-man crew sits tandem at a pivot around which will revolve of the wing.

Rate of descent as a sailplane is 0.5 ft./sec. at 40,000 ft., and 0.2 ft./sec. at 60,000 ft.

A series of three aircraft will be constructed.

Eastern Renovates Passenger Services

Airline aims at faster check-in and baggage handling, streamlines on-time departures and in-flight service.

By Gloria Gorman

New York-Eastern Air Lines, convinced that airline service in today's competitive markets depends largely on a reputation for passenger service, is completing the first phase of a program to promote its revamped service standards.

Eastern acknowledges it had a long way to go in becoming a proven passenger reputation in airline service. Under new president Michael MacLachlan, however, a complete renovation of the passenger service function has taken place and the airline now is in the midst of a large-scale advertising and promotion campaign to push its new service image.

Sections of four departments were reorganized in February 1980, under a new customer service department headed by Vice President Robert L. Hunt. And its program has included the following major improvements:

- **Individual attention to the passenger** through "framing" of the company coverage, including newly appointed customer service representatives at major terminals to assist with individual passenger problems.
- **On-time departures** now strictly last month's record: a new high with 76.9% of 70,000 flights departing on time and 90.6% departing within 15 min. of schedule.
- **New check-in procedures**, including express check-in counters with the aim of speeding the customer's passage to the aircraft.
- **Baggage handling** speedier through expansion of equipment and personnel and a new use of self-climate facilities and conveyer systems.
- **In-flight services** revamped, including a new food service organization and public, and changed procedures for bar, trolley, training and supervising flight attendants.

Eastern's new air-standing reputation program was added by the previously tough competitive position the airline took multiple competition over its price levels, and its present reliance on a fleet of old equipment. Surveys by Eastern itself, its advertising agency and others indicated that Eastern ranked far down the list in service quality. Major complaints included the lack of personalized attention, baggage handling problems, in-flight service and flight attendants which left something to be desired.

With its intense new program, Eastern has hopes to improve its service image as its competitive image for passengers.

For example, in response to Eastern's traditional multiple advertising.

Times, who went with Eastern to carefully to take the new customer service check up after arriving at its new headquarters, with the Air Transport Association, told American Wire that his latest organizational setup was completed last August. But the personnel changes he said, wasn't begun until he had something to back it up.

Improvements in service have already shown in results. Turner said, he has only available yesterday's higher engine mileage, and good public reaction as expected in letters to the company.

The new department took into account the functions of each of four customer departments. I was traffic it checked reservations and take ticket orders from ground operations, about all time and service the department's responsibility. All aircraft dispatching function except work and clearing during major maintenance periods, but flight operation, able service including attendants and catering.

There were four divisions of the new department, and that principal functions, as follows:

- **Agent service** handles ramp procedures and the administration of airport ticket counters and gateways.
- **Building** This division is engaged in three major projects—expansion of its existing baggage on-time departure record, and streamlining of check-in counters to become more efficient.
- **Baggage** equipment designed into the terminal will be the temporary solution to baggage handling, but Eastern couldn't wait for that development.
- **In-flight service** Eastern's new in-flight service has been called "beige thought"—a mixture of personal care, tips and the like and boosting the morale and efficiency of the linehaul. As an example of the change, Eastern said that at Los Angeles in the airport that last day arrived at the plane (number 4) min. after arrival compared with an average of at least 12 min. previously. Passengers arriving at the plane next, Turner said, have been in some cases waiting for baggage that already had arrived (not being accustomed to such speed) and that has been necessary to install right along the passengers to see if their bags are already there.

In the on-time campaign, there has been a much broader use of gate as planes. Equipment is kept out of scheduled service or routine maintenance and spotted at key locations to take over if necessary to avoid delays.

These expenses are not committed to change flight. Eastern means effect has been shown in getting up control center at major stations. These centers follow a checklist of items needed to depart and coordinate the entire process.

For example, if a flight agent finds a duty sign on the scheduled aircraft he notifies the center, which calls were assigned to a replacement. Or if the aircraft has lightning that prohibits flight, the crew is alerted. It then the checklist and calls for action. Eastern has installed boards in communications to go with the control center concept.

For example, in tips, for instance, Eastern is training its new baggage employees in a comprehensive baggage handling and baggage handling. Eastern is training its new baggage employees in a comprehensive baggage handling and baggage handling. Eastern is training its new baggage employees in a comprehensive baggage handling and baggage handling.

Third Major Project

The third major airport service project, check-in management, has involved members of express check-in positions for passengers with tickets at all major terminals. Other staff have been established in the arrival of baggage and the handling of passengers. For example, checking of reservations has been eliminated. If the passenger says he has a reservation, he is processed to leave on time. The whole effort is devoted to giving the passenger and his baggage automatic from terminal entrance to aircraft gate with a minimum number of stops or no stops at all.

• **Traffic services** also works on the check-in project. It also handles some ticket service control, and on ticketing office. A major effort has been in cutting telephone answering lines. Currently, the goal was to save 75% of answering calls within 15 sec. and that has been achieved to 80% and Turner said, is generally being met in terminal.

• **In-flight service** has revamped the flight attendant and catering program. A new baggage handling solution of streamlining baggage service representatives accompany personal people in screening interviews. The streamlining has been shown in the airport, such as screening for a woman instead of a man. Such details at mid-air and handling new recent more rapid standards. Turner said: "The girls are now more looking and better trained." Another change was the selection of the streamlining baggage service groups under the control of supervisors with more authority, providing better job control and communication.

In the catering area, a new supervisor in the dining and policies have been radically altered. After other things, the number of catering stations has been reduced and better service too.

both have been confirmed. A video screen at night night is offered, and the program actually has resulted in a significant increase in sales.

In addition to the work of these divisions, the customer service department handles some vital functions such as: publicists, supervisor training, and control of all distribution. The department also cooperates with local thinking for such programs as Eastern's "asked" and "asked" services (AWM No. 3, p. 40).

Among the projects of the department, the most significant is a study of the effect of computer use on baggage delivery. First, what the computer is going to be able to provide, and second, what effect there will have on personnel. Eastern is training its new baggage employees in a comprehensive baggage handling and baggage handling.

At the same time a separate presidential baggage board, among the most of 50-day study of International Association of Airlines flight operations on Northeast Airlines, last January, recommended that the airline employ three times as many as on-board baggage clerks to do its own crew members. Eastern is now in the process of job positions of potentially eligible flight engineers.

In addition to the merger proposal, the presidential commission under Chairman Nathan P. Ferenbach agreed that all parties to the dispute commence negotiation within 30 days on the following points:

- **Timeline** Flight must on all airlines be scheduled by a three-day operation. On contract using a two-day crew, the commission said, flight engines should be returned and not required to take pilot training. However, the report stipulated, the request was that the airline should be allowed to select, such as screening for a woman instead of a man. Such details at mid-air and handling new recent more rapid standards. Turner said: "The girls are now more looking and better trained." Another change was the selection of the streamlining baggage service groups under the control of supervisors with more authority, providing better job control and communication.
- **Crew reduction** should provide that the three parties will evaluate the present functions of the flight engineer and "some kind of pilotage duties." First, a study revealed that American crew were on "accident of collective bargaining" which "should stop right now." He later added that while Federal Aviation Agency officials were the importance of flight engineer functions, they do not stipulate that only FEAs members can perform these duties.
- **Provisions from ALPA** that it will not

suit of companies can, and in so far as possible to benefit the system in air and engine station.

In addition to the customer service drive in streamlining of engine, service and service. For example, Eastern has exhibited "personalized relations" its accomplishments "there and to be seen" and the system can be conducted by passengers in follow employees, avoided a sales cap and given a workload of entertainment in New York. First of the low-cost, low-cost was held last December. Sample women have flight attendants on a Sun Jet-Midwest flight cancelled at Richmond, Va., because of weather who accompanied the passengers on a chartered bus to New York. Eastern is also working on national services for the passengers.

Board Asks FEIA-ALPA Merger

Washington—Merger of the Flight Engineers International Association with the Air Line Pilots Assn. was the major recommendation last week of a special committee of the Board of Directors to strengthen the engine's negotiating position of union affairs last February.

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"In the near future" seek any further representation rights from other airlines involved in the election vote in process in August. ALPA said the National Mediation Board would remove FEAs' position in its proposal of their job security by an expression of this process. Ferenbach said that the executive election battle on the United States is scheduled for May 20 counting. As an alternative, but a "condition of settlement" of the all-out negotiation, the report recommended that FEAs and ALPA "merge, consolidate, in take other appropriate cooperation with the union to the union."

- **Joint Committee** an Inter-Union Committee should be established by the two unions.
- **Should Western Air Lines continue** its refusal to share striking engines, the commission will ask the carrier to agree to the appointment of a neutral party authorized to make recommendations in the matter after hearing both sides.
- **Initial beginning** of all crews should begin immediately and take place in Washington under the auspices of the commission. If the parties fail to commence negotiations on the union's proposal, the commission will, 30-day period, the commission then plans to move forward and recommend such further action "as may then seem desirable."

Release of the report also indicated new agreement between President Kennedy, who urged his full compliance and emphasized that "one thing is clear: we cannot have further strikes over these disputed issues. There can be no legitimate excuse for interruption of the nation's air service. These negotiations have marked out the area of fair and reasonable settlement. The public deserves, expects and demands that such negotiations be reached."

Eastern Omits Dividend

New York-Eastern Air Lines advised stockholders that the quarterly dividend on common stock had been omitted because of a strike, the need for cash to finance the carrier's jet program, and "unstable public sentiment" during the present economic and social conditions in the industry.

Eastern had paid a quarterly \$5 cent dividend since Nov. 13, 1975, and an additional \$10 cent dividend in 1976. The stock has been paid dividends since the end of last quarter dividend since Dec. 13, 1976.

The brought a sharp rejoinder from Norman Ashton III, Concord Eagle director and company co-owner, who said the question of Concord's business was "an extremely sensitive" that it would

dodge its obligations to the public." All of Conrad Eagle's operations, he stressed, would be fully backed by the parent company, and a letter to that effect was submitted as evidence.

In putting General Eagle's case for a license, Ashura III claimed that "there is no state in the world which abhors of dual participation, this is the one." He pointed to vast populations, areas at both ends of the North Atlantic service, and the growing wealth of the North American market.

Canard Eagle, he continued, is "not out to take the cream off the market but [BOAC] has had

"We are not to participate, in the interests of British aviation as a whole in a route on which the traffic flow, in our submission, is such that it warrants a second British operator."

Toothbrush Invention

Adrian Hill said the average increase in traffic over the North Adriatic was about 22% in the past five years, with one exception, this average has been exceeded. In 1990, the average was 34.7%.

Conard Eagle, according to Ashtabula HRI, has the background, staff and will have the equipment to operate the route satisfactorily. Conard Eagle should be allowed the route, he said, because:

- Lower taxes, which are inevitable, will stimulate traffic even further

Modified Argosy 650 Goes Into Production: Aloha Shows Interest

London—Armstrong Whitworth has started production of a Soviet 200 An-gar 650 turboprop transport, incorporating a major redesign of the wing structure for a fully fail-safe concept.

Offshore and the new model will include a box spar type wing, to gain the fail-safe concept through better distribution of wing loads. Present wing is of the mono-spar box type.

Seas 200 Agency was expected at Armstrong Wharfedale's Corbion, plant by Hong Wa Ching, president of Aloha Airlines, and Kenneth P. C. Chai, Aloha vice president in charge of operations. Ching said Aloha is "greatly interested" in the Seas 200 model and is considering eventual purchase of two airplanes for air cargo service in Hawaii.

Alpha saw operators Fairchild F-27 turboprops in scheduled passenger service and last month reached a peak load factor of 68%. The airline has made earlier flights on its sole competitor, Hawaiian Airlines (AW Mar. 21, 1986 p. 49) and attributes much of its success to turboprop convenience. Clam-

• Growing wealth of the wage-earner in the United States

- Captain Eagle's past experience on overseas routes, including charters and Britannia service from London to Bermuda

• Pan American and TWA operate in competition with each other and with other foreign carriers yet the United Kingdom has had but one operator "for legislative reasons."

• **Conard Eagle** will enter the service with modern jet equipment because it is

is available and is considering the purchase of British-made airplanes in the future.

• Concord Eagle has the 'Tail backing and financial support' of its parent, Inc. Concord Steamship Ltd.

• Number of passengers carried on the North Atlantic last year—more than million—was “but a drop in the bucket of the population” at either end of the route.

- Curlew Eagle has developed into a raptor or carver without any form of mimicry

Coastal Eagle used it would start its service, if a license was granted, between London and New York City. Application also includes a request for service to Boston, Philadelphia and Washington-Kalamazoo, in addition to the Canadian cities.

Announcement of the Board's findings is not expected for some months. Both sides have the right of appeal.

and Allyn will close a profit this year.

Alaska has supported a proposal to establish a state-owned air ferry service connecting the six main Aleutian islands (AW Feb 20, p. 17) but the state legislature has turned the proposal down and now is studying possibilities of surface ferries, possibly hydrofoils.

Air-Corneo Head

Chang said he is convinced of the value of air cargo service as a boost to the Hawaiian economy and now is undertaking a market survey aimed at Aloha's capabilities where equipped with two Argosies. One possibility is air freight of dressed cattle from ranches to urban markets, and haulage of fresh vegetables. Aloha also is studying the airbus plan, to be used in mixed passenger-cargo configuration.

China convinces the need for passenger service on short hauls in the Eastern Islands by 1965 and last week inspected the BAC 311 short-haul jet (AW May 15, p. 42). No firm commitments have been made for either the Anson Series 200 or the BAC 311.

CAB Reorganization Before House Unit

Washington - House Government Operations Committee late last week

was expected to report favorably on President Kennedy's plan to organize Civil Action Service based on it to allow board members more time for strategic policy and planning decisions.

Under the proposed legislation which is based on a report drafted by presidential adviser James M. Lardy (AW Jan. 2, p. 26), the CAR share rates would be contrasted with those

authorities to delegate power to develop less complex issues to individual board members, leaving constraints and high-

Testifying before the House Selects committee on Commerce and Legislative Reorganization, CAB Chairman Alan S. Boyd predicted that the Board

would proceed with "considerable reserve" in delegating authority. Even though most tasks could be delegated

to senior staff officers such as bureau and office heads, Bond warned that the right risks the delegates unavailable for work that might be even more important.

Based on the statistical evidence of the CAB workload over the last five years, this disclosed that about 65% of the Board's time was consumed by adjustments, and housing cases; that in about half such districts, the Board followed the summer's decision without changing it and that in foreign permit applications, the Board sustained the summer's decision about 95% of the time.

Asked for a prime example of a subject suitable for delegation, Boyd singled out "use it or lose it" proceedings held to determine whether restaurants served by unlicensed servers were generating enough traffic. Enacted in 1957, this use it or lose it policy has been tested, challenged and interpreted, Boyd said, and "we know what it is." As a result, hearings are fact-finding rather than adjudicative, in effect.

Trans Caribbean
Orders Turbofan DC-8

New York—Trans Caribbean Airways has ordered a turbofan-powered Douglas DC-8 for delivery next October and has optioned a second DC-8. The airline expects to put the jet into operation on its New York-San Juan run in December.

Price of the virtual codes, including spares, is \$6.5 million. TransCashless is negotiating with other airlines to lease a jet for the summer for use on the route.

BRITISH
AIRCRAFT
CORPORATION

announces

BAC
ONE-ELEVEN

THE SHORT HAUL JET

JET SUCCESSOR TO THE VISCOUNT

THE SHORT HAUL JET



- 540 m.p.h. cruise speed
- 57 mixed class or 69 tourist passengers
- Short airfield performance
- Quick turn-round: built-in auxiliary power unit
- Cabin width for spacious five-abreast seating

**JET SUCCESSOR TO THE VISCOUNT
WITH EVEN BETTER THAN VISCOUNT ECONOMICS**

BAC
ONE-ELEVEN

TWO ROLLS-ROYCE SPEY TURBOFAN ENGINES

...and built by

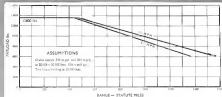
BRITISH AIRCRAFT CORPORATION

BAC ONE-ELEVEN

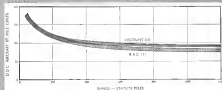
THE SHORT HAUL JET

- 540 m.p.h. cruise speed
- 57 mixed class or 69 tourist passengers
- Short airfield performance
- Quick turn-round: built-in auxiliary power unit
- Cabin width for spacious five-abreast seating

PAYLOAD - RANGE



ECONOMICS



BRITISH AIRCRAFT CORPORATION
ONE HUNDRED FILL MALL, LONDON SW1, ENGLAND

Airline Traffic—March 1961

	Revenue Passengers	Revenue Passenger Miles	Passenger Load Factor %	U.S. Mail Ton-Miles	Revenue Ton-Miles	Freight Ton-Miles	Total Revenue Ton-Miles	Overall Revenue Load Factor %
DOMESTIC TRAFFIC								
American	812,380	440,458	58.7	2,354,261	840,749	1,841,282	2,682,031	52.3
Northwest	112,514	121,681	68.1	489,122	175,465	181,117	356,582	40.4
Capital	291,875	118,689	68.9	497,120	327,178	108,412	435,590	60.7
Continental	110,704	18,420	40.8	280,379	116,561	111,243	227,804	30.7
Delta	814,602	116,894	42.1	492,172	211,433	1,128,110	1,339,583	50.9
Eastern	691,844	379,252	53.4	1,507,104	570,744	3,414,370	4,085,058	42.0
Midwest	140,377	70,214	48.4	274,476	46,477	1,054,282	1,100,759	44.4
Northland	132,791	76,264	68.7	138,173	16,240	278,270	294,510	42.0
Southwest	47,301	47,312	100.0	211,476	65,411	448,347	514,808	46.4
Texas World	215,449	226,611	68.2	1,721,544	854,837	4,814,260	5,689,337	50.7
United	691,881	410,110	68.9	4,446,658	1,167,179	6,111,136	7,278,315	52.8
Western	27,433	20,844	41.2	70,787	34,273	164,736	195,009	55.7
INTERNATIONAL								
American	2,801	6,898	46.1	16,779	807	320,884	1,241,492	31.5
Northwest	7,201	11,218	66.2	30,458	157,314	1,414,418	1,571,732	42.7
Continental	2,805	88.9	2.448	19,348	19,348	277,469	296,817	46.5
Delta	1,394	1,394	100.0	1,144	16,418	119,224	136,742	38.8
Eastern	47,182	71,932	37.2	171,943	16,881	2,291,487	2,308,368	37.3
Midwest	14,074	2,601	53.9	—	—	277,413	277,413	32.3
Southwest	10,430	19,151	45.8	1,638,070	1,478	219,124	4,218,875	44.8
Texas World	3,729	2,729	38.8	48,578	1,729	152,543	164,272	44.0
United	114,584	131,241	67.4	2,814,441	2,211,114	2,814,441	5,025,555	42.7
Delta	84,714	112,200	39.6	410,432	4,410,270	16,819,347	21,639,649	40.1
Pacific	46,298	116,667	68.9	3,448,666	16,584	2,847,463	33,172,626	39.8
Panama	12,241	18,241	39.4	104,214	240,114	5,468	2,406,136	30.9
Southwest	8,241	12,241	48.0	1,144,300	—	88,741	1,233,041	43.8
Texas World	18,412	22,207	41.8	1,741,814	1,741,814	1,741,814	3,483,628	47.8
United	11,750	38,825	41.6	249,104	7,316	101,817	2,413,836	37.2
Western	1,780	2,780	85.0	5,212	11,208	379,442	390,650	52.7
LOCAL SERVICE								
Allegiance	40,240	12,077	39.7	25,101	22,171	38,103	1,315,237	40.4
Allegiance	29,200	7,197	24.6	15,914	3,446	11,197	241,646	12.4
Capital	18,413	3,102	32.2	12,422	6,176	11,028	335,397	39.4
Pacific	29,619	9,264	45.0	37,443	27,443	12,443	320,443	42.2
Delta	4,719	6,025	45.0	7,027	29,812	4,418	484,198	40.4
Midwest	55,418	11,214	42.5	31,712	26,140	20,788	1,347,144	41.1
Northwest	17,812	14,024	68.0	16,214	16,214	1,144	1,144	42.4
Southwest	46,142	8,249	40.6	25,719	21,264	21,264	825,264	44.8
Pacific	48,812	9,411	41.0	11,760	6,476	6,100	144,600	42.4
Panama	28,474	7,452	40.7	12,452	16,452	16,452	16,452	44.6
Southwest	11,414	3,447	30.4	33,411	12,500	18,450	207,450	40.4
Texas World	26,750	6,142	40.8	34,767	11,321	42,070	467,401	42.8
West Coast	11,742	8,508	42.5	18,147	5,811	19,192	153,192	40.9
NAVY AIR								
Allegiance	27,287	4,123	44.7	3,127	8,179	264,288	272,467	32.8
Allegiance	15,702	2,472	30.7	2,467	17,210	487,399	487,399	44.8
CARGO TONS								
American	1,829	9,028	40.4	84,020	45,174	7,352,534	8,480,648	27.2
Northwest	1,127	6,448	56.1	1,041,479	2,815,214	4,426,049	64,264	44.4
Delta	1,127	6,448	56.1	1,041,479	2,815,214	4,426,049	64,264	44.4
MAIL COPIES TONS								
Chicago	17,216	227	32.7	1,171	1,171	21,171	21,171	48.8
Los Angeles	2,354	139	19.8	5,119	3,467	21,372	21,372	48.8
New York	11,191	248	36.8	1,327	474	17,790	17,790	55.4
ALASKA TONS								
Alaska	7,102	2,104	41.6	72,241	1,410	211,202	945,892	50.1
Alaska	4,242	1,242	50.4	2,927	4,410	50,404	50,404	42.8
Continental	1,450	309	42.6	6,441	34,082	66,811	47,717	47.7
Delta	2,412	257	10.7	2,412	3,412	46,104	46,104	38.4
Southwest	418	408	94.8	414	414	414	2,414	41.4
Northwest	2,022	813	39.7	44,200	41,419	715,894	715,894	38.0
Pacific	2,127	7,127	66.6	304,574	304,574	304,574	304,574	38.4
Eastern	1,276	1,197	37.7	27,273	38,473	846,891	846,891	38.8
Western	2,177	447	24.8	45,320	108,015	112,404	412,404	47.8
Alaska	2,340	229	45.9	643	436	98,778	98,778	47.8

¹ Not available

² National has suspended service to Reno, Nev. only International route

operated by AIRLINES (1971) has a 40% share in the CNV Agreement for Reno

³ Operations suspended



AVIDERIDGE used to shield jet passengers during takeoff of smaller airplanes to 100 ft. In length, one more AVIDERIDGE will be built to stand at up to 60 deg. Built by Hefland & Avidan, Maastrichtse Vliegvechtheuse N.V., it can be ported on 120-000 tons.

Devaluation Spurs KLM Modernization

By David H. Hoffman

Amsterdam—KLM Royal Dutch Airlines, with almost 20% of its shares in U.S. hands, is considered that heavy emphasis on modernization—coupled with Los Angeles landing rights—will ensure continued profits until the transition to supersonic transports gets under way.

To underwrite its preoccupation with the future, the airline has begun a series of month projects here that range in scope from fully automatic

landings to concrete contracts for all seven within the company. Substantial investment in these areas, KLM feels, will tend to hold down costs and thus lower next years' losses on fuel alone.

At the same time, KLM admits that the Dutch government's decision to devalue the guilder will strongly affect cost savings over the next five years. Precise impact of the 4.74% devaluation announced in March will be discussed by forthcoming 1968 statistics that show losses have already hit the

airline. The currency advance will have done more to hurt KLM and U.S. banking and aviation industries.

There is historic resentment built up, as based on the U.S. dollar and the United Kingdom's recent sterling. Now worth 1.6 instead of 1.5 Dutch guilders, a dollar earned by KLM means in about 15% less net income than it did before devaluation.

In an effort to offset this loss, the airline can be expected to increase the proportion of its operating expenses that are satisfied with foreign currency. The bulk of this expense probably will benefit U.S. suppliers, which can be relied on to deliver to KLM.

• Credit line of \$70 million, extended to the carrier by three U.S. banks—First National City Bank of New York, Chase Manhattan Bank and the Bank of America National Trust and Savings Assn.—The bank-union agreement stipulates that loans may be used only to purchase new equipment.

• First KLM commitment to utilize only Douglas DC-8s, ensuring their return, outside at logbooks, at frequent parking availability at major airports. According to the Air Transport Loss, the purchase and maintenance of one DC-8 over a 10-yr period requires \$12 million of service for U.S. airlines.

• U.S. stockholders' interest in the airline. About 40% of outstanding KLM common shares are held by the Dutch government. But by owning 10% U.S. interests from the second round sale, and the airline reports that 40 American holding KLM shares own covered their conversion privilege.

the U.S. share of ownership would jump to 35%.

Despite a substantial drop in Lockheed electric load factors and mounting competition from government-subsidized carriers in Europe, KLM showed net earnings of \$27 million last year. But because operating expenses increased 14% while revenues rose only 11%, net earnings were \$1.2 million less than in 1975 and dividends were paid to 5%.

KLM distributed a 7% dividend in 1978, the highest in an unbroken string dating back to 1933. According to KLM officials, who chose not to elaborate, European passenger traffic to the shores of U.S. Electric airlines in 1979 and 1980 was far more "disappointing" than comparable statistics in the U.S. to the only major Electric operator in Europe last year. KLM scheduled the turbofans along medium-range routes also served by Red Carriers and 800 Series Westerns.

One source of this competition was last year's KLM decision to withdraw \$1.5 million from its accounts to cover "extra expenses and loss of revenue" attributable to Electric problems. Another was the KLM's plan to transfer its Electric to relatively short-range intra-European routes, as more in medium-range jets can be acquired.

KLM has not yet decided on the jet it should buy. It has, however, decided to make a purchase that can and otherwise have expected the announcement automatically in manufacturing agreements meet aircraft with the airline's top management. Annual under consideration include the Red 747, 10 Conquest, de Havilland Trident, Convair 440 and 580 and Boeing 727, with delivery the key to the carrier's final choice.

While awaiting the arrival of new aircraft, KLM has undertaken projects aimed at boosting the efficiency of its present jet fleet—which now accounts for about 50% of total airline revenue—and at cutting in-house costs. For example:

• Fully automatic landings. KLM assumes that for air traffic control purposes, automatic landing capability—including automatic flare-out—will be required at the expense transport when it is introduced. To anticipate that, the airline has established a "supersonic steering group" and an advanced instrumentation or flight guidance department.

By testing various devices on DC-8s, these two groups hope to achieve automatic landing capability "either to the right turn," or well before the radius of altitude of supersonic transport availability. But their intermediate goal is to lower current DC-8s costs to \$340k, ending and 1.5m, vi-

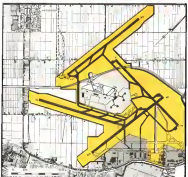
stability in steps—first to 200 ft. and 1m at once as possible (AW Apr. 24, p. 46) and then to 100 ft and 1m by 1985 at 1984.

As a related step, KLM has installed a Dual Visual Distance low visibility approach system at a DC-8 for evaluation this year, the first such installation in an operational airline jet. Manufactured by Swedish Aeronautics Institute Ltd. of Gagnef, Sweden, the PVD floods altitude and weather information to a pilot exceeding a low visibility approach even while he is looking outside the cockpit. It thus takes the problem of increasing from instrument to

visual flight on let down through a low, fogged ceiling.

KLM also intends to install a three-antenna computer and a radio altimeter in a DC-8 this fall. Evaluation of these will require the laying of cable "leaders" about a station of the so situated landing system located at Schiphol Airport to improve ILS accuracy just prior to touchdown. While this project is under way, KLM will partly share with a "no-decision" program aimed at bolstering pilot confidence in approach with already installed in the carrier's jet fleet.

• Expansion of Schiphol Airport. Op-





From city-to-airport service...to 5400 mile nonstop routes



...there's a Boeing jet to handle the job'

Now, airlines can service, from a single source, turbine-powered aircraft in series every route, from 5 to 5400 miles.

The Boeing jet "family" ranges from the Vertol 107 heli-copter to the newly-manufactured 747-200 liner contained with full payload range of 5400 miles. It between are the nonstop transcontinental 707 jetliners—the sleek, 720 for routes up to 3300 miles...and the newly-manufactured Boeing 727, for routes from 150 to 1500 miles.

Available also are "T" models of the 707 and 720, equipped with twin, more efficient turbofan engines.

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Three 24 models (plus 1470) have entered 270 Boeing jets, all France • Australia • Argentina • Africa • B.E.C. • Brazil • Central America • Canada • Colombia • Costa Rica • Cuba • Cyprus • Denmark • Finland • Germany • Greece • India • Iran • Israel • Japan • Korea • Malaysia • Mexico • New Zealand • Norway • Pakistan • Peru • Philippines • Portugal • Saudi Arabia • Singapore • South Africa • Spain • Sweden • Switzerland • Taiwan • Thailand • Turkey • U.S. • United Kingdom • Venezuela • West Germany • Yugoslavia • Zaire. Boeing 747-200 jetliners have been ordered by NEW YORK AIRWAYS and PUG AIR TRANSPORT.

entered by a limited liability company in which the cities of Amsterdam and Rotterdam. KLM and the Dutch government own shares of the stock. Scheduled last year ordered first Boeing 747-200 jetliners in freight and right in passenger traffic.

The airport company, N.V. Luchthaven Schiphol, reports a total of 93,000 aircraft movements and 1.5 million passenger movements last year. It forecasts that these figures will jump to 140,000 and 2 million respectively in 1975.

To accommodate that volume of traffic, the airport and its principal user, KLM, have chosen a 550-million common program scheduled to get under way in 1967. Among other projects it will extend the extension of three runways to 11,000 ft and the construction of a new passenger terminal with gates that incorporate 100-150 sq ft moving sidewalks for exploring and departing passengers.

The terminal, when finished will stand at the center of a rough rectangle formed by a pair of parallel runways. The fourth runway has been lengthened to 11,000 ft. With the runway radiating from the terminal complex some, what the airport calls distances for north and south are kept to a minimum because aircraft land toward the terminal and take off away from it. The flat Dutch countryside—delay has been 13 ft below sea level on the bed of a lake drained in 1658—offers few obstacles to even the most extreme structural application. Nevertheless, the airport plans to install a fire detection radar next year to detect aircraft losing through fog and a considering BLS installations on all four of the taxiways to complement the two Precision Approach Radar (CAP) units in operation.

•Integrated flight crew. KLM believes that the speed and high automation systems of the expensive transport can lead to a wide concept in crew training and cockpit requirements. A. W. Witte, vice president and manager of KLM's flight division, told Aviation Week here that as the lack of personnel, especially for flight crew, with dual or triple qualifications who could make look from the pilot's seat to the engine's panel to the navigator's table of the expensive jet. How such crewing should be tailored is now under study. Working with 700 relatively young pilots—like pilots must retire at age 55 in the Netherlands—and 400 engineers, KLM is considering the possibility of forming an expensive transport training to the Dutch civil aviation school, which now supplies a majority of the new pilots coming into the airline.

For the first time last year, KLM elected to follow the lead of some U.S.

KLM Freight Rise

KLM Freight Division, which reports that it moved ahead of Pan American World Airways in transatlantic freight volume during the 1961 first quarter in becoming the world-leading cargo carrier on North Atlantic routes. Only Northwest World Airlines, which carries significant quantities of freight under letter-of-carriage, but more cargo business from KLM. Ranking fifth among letter-carriers, Air Transport Association in 1960 transatlantic passenger movements, KLM shows that it accounted for about 25% of all North Atlantic freight business last year.

Excluding mail and cargo shipped through Montreal, Houston to Caribbean airports, KLM loaded 3,227,977 lb of combined cargo and 2,683,210 lb of combined cargo in 1960.

which is equipping transport aircraft. These totaled about 534 million for overall upgrading.

In its maintenance division, KLM has adopted some Boeing overhaul techniques to achieve DC-8 reliability of 13 years during the same month when traffic in it is paid as the service North Atlantic routes. For example, KLM sends its DC-8s through major overhaul only in winter, allowing 15 to 2 weeks of longer time per month.

Mixed Maintenance Concept

Others won't be accomplished during 1967 for the company's fleet. The KLM Board has chosen a maintenance concept popular in the U.S. with a "one-line" overhaul system to maintain conflicts with the maintenance man's traditional custom—the traffic and sales department.

Because overhaul is recognized to the winter months, managers available for fleet maintenance change during the winter when KLM DC-8s, at a cost that, it claimed, will cost about equal to annual amortization of 4,600 for 10-year workloads are large relatively constant, including engine shifts and engine scheduling. And because of the seasonal peak in the KLM winter drive now there is still left over for winter operations and special maintenance training.

The problem of increasing engine time between overhauls (TBO) in KLM had undermined the unusual relationship between KLM and the Dutch government, most particularly, its federal aviation agency Rijk Luchtvaart Dienst.

It is often said here that "KLM is end service in Holland," a country as small that the nation's pits become it in less than 20 miles. It is also true that KLM represents the government's

plus a source of technical advice knowledge.

The outcome of that relationship is that the owner can be sure to control the maintenance of its own 747s. KLM does this by preparing its own engine overhaul program, which almost is essential, as approved by the Dutch government. The "one-line" overhaul operation of the engine capital in KLM in this area, the TBO of one engine was extended by 200 hr at a time when its failure rate rose annually by 10%.

Despite the added investment, the number of failures attributable to its prospective continued contract with KLM engineers satisfied the owner of trouble. Under the U.S. federal aviation law, the airline's Federal Aviation Agency (FAA) would have been called back. But KLM reasoned that because none of the failures occurred during the last few hundred hours before overhaul, TBO could be increased without compromising safety and did so with government approval.

FAA Proposes Early DME Installation

Washington — Federal Aviation Agency has proposed a rule requiring U.S. airlines to equip their transport aircraft with distance measuring equipment to monitor rather than the installation timetable declared "mandatory" by the FAA.

Under the proposed addition to the Civil Air Regulations published last week in the Federal Register, FAA would require DME on:

- All new aircraft by Jan. 1, 1962
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AIRLINE OBSERVER

► **British Overseas Airways Corp.** is expected to announce plans to operate its new passenger terminal at New York International Airport under current regulations and under a new plan at the Port of New York Authority. The new terminal would be operational by 1964, when B.O.A.C. begins present facilities at international arrival building will no longer be adequate. Passengers handled by the airline at Idlewild last increased 147% during the past four years.

► **International Civil Aviation Organization** has recommended to 34 airlines that airline transport pilots bring international routes relief at age 60 "because of the decreasing possibility of sudden incapacity as a pilot with advancing age." The proposal was "strongly contested" and ICAO, but was passed by a small majority of votes cast.

► **Federal Aviation Agency** has proposed that all aircraft operating in positive control areas be equipped with a radio beacon transponder that can transmit coded identification signals to ground radar systems receive. If adopted, the proposal would apply to all one positive control area at the time—the airspace from 24,000 to 35,000 ft. covered by language radio from Chicago Indianapolis and New London Ohio.

► **Czechoslovak State Airlines** will inaugurate weekly flights between Prague and Beirut next month on the Far Eastern route. The Czechoslovakian government, meanwhile, predicts that CSA "will fly to all parts of the world except Australia, by the end of 1963."

► **British Air Transport Union**, representing 25,000 airline employees has purchased Tachibana, Ltd., a long abandoned airline with neither aircraft nor assets, as a legal means of gaining recognition before the Air Transport Licensing Board. Currently negotiating with British United Airways, the union contends that purchase of the airline will enable the union to register objections to airline applications. Tachibana has active operations at Basel, Innsbruck in Austria, owners of transport companies, holders of airport licenses and government departments (AW May 25, p. 34).

► **Air Line Stewards and Stewardesses Assn.** accept affiliation with the Transport Workers Union may be significantly weakened as a result of an Air Line Pilots Assn. progress to conduct representative elections on the airlines. By last week a majority of flight attendants on United Air Lines, Braniff Airways, Mohawk Airlines, Pacific Northern Airlines, West Coast Airlines and Alaska Air Lines had elected ALPA to represent them as a collective bargaining agent. Additional elections are in progress under the National Mediation Board at Continental Airlines, Capital Airlines and North Central Airlines, with others pending at National Airlines, Overair Air Lines, Piedmont Airlines and Frontier Airlines.

► **Jetcraft**, the start-up and airline of Rayco, has inaugurated its first non-scheduled turboprop and turboprop service to Kailash, on the Volga River, and to Minskine Vokh, a resort town in the Caucasus. Both cities recently completed airport improvement projects.

► **International parties** in New York's Dec. 16 mid-air collision do not anticipate an assumption of public hearings on the tragedy's cause before July. A major reason for the delay—phase one of the hearing ended last January—is to give Civil Aeronautics Board time to coordinate information from 40 flight records furnished by airlines operating jets into the New York area.

► **Civil Aeronautics Board** is using U.S. airlines to conduct month-long analysis of the accidents from flight records stored in their turboprop transports. CAB feels that the flight recorder tapes now indicate the need for maintenance action after aircraft have been subjected to unexpected g forces.

► **North Atlantic last** been dropped an average of 7% during the first quarter of this year as compared with the same period of 1960. International Air Transport Assn. figures show the decrease resulted from a gain of 23.8% in passenger control against a 46.9% increase in available seating capacity.

SHORTLINES

► **Air France** has begun monthly service, three times weekly, from Paris to Moscow with Caravelle turboprops. Flight time for the route is 3 hr 35 min.

► **Braniff Airways** will utilize a 51-seat jet turboprop in operation at Love Field, Dallas, by next August. The turboprop, built by Ford, is a combination of a Boeing 737 cockpit and an electronic computer which will be used to trim jet costs and give proficiency checks.

► **British European Airways** and Russian Aeroflot are adding 51-seat flights with Caravel 40 and Tupolev Tu 104 equipment between London and Moscow during the May 19-June 4 British Tourist Fair in Moscow. B.E.A. is adding 15-hour flights and Aeroflot 17 to the six flights weekly now being flown by the two airlines.

► **Frontier Airlines' leaders** have a Civil Aeronautics Board guarantee for losses totaling \$800,000. The guarantee will allow Frontier to purchase two Convair 440s to replace DC 8s.

► **Japan Air Lines** reports a gross profit of \$50 million for the fiscal year ended Mar. 31, 1961, an increase of 10% over the preceding fiscal year. Net profit for the same period was \$1 million, a 59% increase over the preceding year.

► **Lufthansa Airlines** has declared a dividend of \$1.5 cents per share or 64% of \$2.30 per share paid-out stock for the period Mar. 1 through Mar. 31.

► **Earlthorne Airways Airlines** carried 3,344 passengers and 3,745 mail parcels during the first quarter 1961, a gain of 86% and 115% respectively over the same period last year.

► **Northwest Airlines** declared a quarterly dividend of 25 cents per share for common stock and 12.5 cents per share for 5% preferred stock.

► **Pan American World Airways** reports over 500 tons of cargo carried non-stop over the North Atlantic during the week of Apr. 15 aboard 14 DC-79, 11 Douglas and 51 scheduled passenger flights.

► **Southwest Airlines** is making arrangements to serve Clarksville, Tenn., Union City and Decatur, Tenn. for the first time on June 1. Flights will be twice daily for each city and originate in Memphis and terminate in Knoxville, Tenn.

Compact, in-line mounted constant speed drives are ideal for turbofan-powered aircraft.

No in-line constant speed drives in airline service have flown longer and operate more reliably than those made by General Electric.

G-E in-line mounted hydraulic drives are now flying on Convair 440 (TWA, Delta, Northeast) and Convair 440.

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10-04

Progress Is Our Most Important Product

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FIRST PRODUCTION 880-M, originally scheduled for delivery to Capital Airlines. High lift devices are all retracted in short view.

Aviation Week Pilot Report:

Takeoff Distance Cut on Convair 880-M

By William S. Reed

San Diego, Calif.—Addition of high lift devices to modified control surfaces will significantly increase flight capabilities. The Convair 880-M (the modified) is expected to increase gross weights while requiring shorter takeoff distances.

Effect of the high lift devices is to reduce stall speed by about 10% with corresponding reductions in takeoff run and takeoff safety speeds. The result is that the 880-M can operate from high altitude airports such as Albuquerque, N. M., without requiring payload cut-backs.

Further expansion of the 880-M's handling and performance, both in landing and maneuver, and reduced weight, as well as low speed maneuverability and stall, were gained by the Airframe Work unit during a recent flight with General Experimental test pilot William H. Hume. Formwork project pilot on this flight and performance program is the F-107 and F-106. Hume says it is 880-M project pilot.

The Federal Aviation Agency issued a proposed airworthiness certificate for the Convair 880-M May 29. This, can later release—Civil Air Transport of Concord, N. C., and Eastern States of Vancouver and Alaska Airlines—were permitted to commence new training and route functions with the aircraft in advance of complete certification scheduled for July.

The aircraft used for this flight was N8447H, the first production Model 880-M. Preliminary investigation of the

wing modifications were made in the original 880 prototype and it was in this latter aircraft that Hume did most of the experimental flying. N8447H is operating under an experimental type certificate, was in the relevant configuration ordered by Capital Airlines, but passenger seats were removed, a photo panel installed in the left cabin and areas of trim reduced so the floor for carrying load would now still in place.

880-M Modifications

Modifications to the 880-M include:

- **Wing high lift devices.** Kongs-type flaps between the leading and the inboard engine pylons increase the effective number of the wing and form a seal between wing and fuselage to facilitate better air flow. These are hydraulically extended with the main flaps. So are the slots added to the outboard of each engine pylon. As a result of these modifications wing chord is increased by 2% behind trailing edge flaps, but greater area resulting from a 14 in. increase in span and an 18 in. increase in chord. Overall result is an increase in maximum lift coefficient $C_{L_{max}}$ from 1.82 to 1.95.

- **Revised outboard wheel pants.** New operation whenever flap travel passes the 8 deg down limit. (Previously wheel pants cut when the flap hit an under differential is greater than 18 deg and the baggage has been changed so that the air streamlines at full down to present a greater area thereby increasing wheel effectiveness. An additional power boost when a flit to the

roller profile and is referred to by pilots as "power steering." This full time boost cuts roller forces by one half, accounting each 80 lb. push force for full roller thrust. Original scheme was to have the boost system activated by a "G" sensor set to come into operation below 140 kt. 145. This not mechanism, however, and has been abandoned in favor of using it to the flap travel.

- **Extended control response is increased** at a result of decreasing wheel thrust for full wheel speed operation from 110 deg to 85 deg. At the same time the control, which produces 50% of the rolling moment, are brought into play with less wheel movement. As revealed later during landing, the direct response of the 880-M is very good, especially, as landing configuration, and little trouble was experienced in "landing control."

- **Thrust increase of 400 lb. per engine** (total gross takeoff weight on the F107-T3 engines have been embedded in power greater area, thus increasing thrust from 13,200 to 13,600 lb.)

- **Wheel bridle designed for longer life.** Despite the increase in takeoff gross weight from 154,500 lb. to 191,500 lb., and the increase in landing gross from 132,500 to 155,000 lb., the lower stall speed results in the 880-M being about the same kinetic energy at lift-off and touchdown as the 880. Increase in kinetic energy is therefore not necessary but longer life is added to the landing system.

Gross weight of N8447H for the Aviation Week flight was 147,000 lb.



HEAD-ON VIEW of the 880-M shows the enlarged trailing edge flap outboard, the Kongs-type leading edge flap between leading and inboard engine pylons and the slots outboard of each pylon on the leading edge.

45,500 lb. under the maximum for which the aircraft will be certified. Above 40,000 lb. of fuel and full people maximum load which can be carried by the 880-M is 75,412 lb.

For the takeoff from Lumburg Field, calculations showed that both V_L (maximum lift-off speed) and V_R (rotation speed) because of the light gross weight were 123 kt. V_L (takeoff safety speed) was established at 134 kt. Outside air temperature was 19C and for these airframe conditions, the maximum gross takeoff (ETPR) maximum was 1.61.

Ground Operation

Ground operation of the 880-M after retrofit was very positive. 880 models and is conducted with about the same rate as with contemporary transports such as the 707-720 and the DC-8 series aircraft. Engine response, a selling point with General Electric, is very rapid more closely approaching that of contemporary engines than most turboprops.

The aircraft is brought onto the runway and the power levers advanced to full open. After allowing 10 sec for the railings to stabilize, EPR is checked for movement and the other engine visual checkboarded. Maximum rpm is 101.1% and the steady state exhaust gas temperature (EGT) limit is about 516C.

Directional control aircraft is maintained by the use of nose wheel steering and reaching 80 kt. stopped. Since the nose wheel will center directional control for all ground operation can be maintained in Johnson use of power/steering handle continuously, but the directional control is slightly longer takeoff runs. Lift-off is accomplished at V_L speed with a manual 40 lb. pull force on the control yoke and the safety speed V_R is attained about immediately.



TIGHT SEAL between the Kongs flap and the inboard engine pylon an effort on the 880. Kongs-type flaps between leading and inboard engine pylons and the slots outboard of the pylon are hydraulically operated and travel to extend with the main trailing edge flaps. Extension of 19% in stall speed is brought about by these devices, first tested by General Dynamics on the 830.



Arma navigates new routes

Navigating with cross-staff and primitive compass, Prince Henry's Portuguese galleon took more than 50 years to find a route around Africa and across India. The Spaniards took another 25 years to cross the Atlantic and reach the shores of Florida.

Today, missile-borne inertial guidance can navigate such distances in a matter of minutes and pin-point targets nearly half way around the world. Other advantages of inertial navigation are commonly

to outside interference, all-weather capability, radio firing, and a minimum of ground equipment.

Arma, designer of America's first inertial guidance in intercontinental range category, has these systems in full production with on-schedule deliveries. Although specified for the Atlas missile, the Arma systems equally are capable in other

air-to-air programs and space exploration projects.

At Arma, research programs currently are exploring inertial, super-sensitive devices for future generations of cruise and space guidance systems. Arma, a division of American Bosch Arma Corporation, Garden City, New York... The future is our business.

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ably. Acceleration to take-off speed and lift-off is very rapid in the SR-71 and take-off safety speed generally was exceeded.

Final climb-out is completed at 97% rpm. Following drop retention at 1,368 ft. Above the runway after the approach has increased to about 180 kt. IAS. Once the missile had accelerated to its route climb speed of about 340 kt., we had broken out from a 5,000 ft. altitude and were headed for the Cape Canaveral area of the Pacific coast near Catalina Island. On passing 10,000 ft. rate of climb was 2,500 fpm, which agreed with the book value at 17 min for a climb from sea level to 34,000 ft.

To demonstrate handling qualities, the SR-71 was leveled off at 14,000 ft. and various maneuvers were executed to demonstrate stability and control. Dutch roll (yaw in one direction, roll in the opposite) was induced in the aircraft. Pitch put in about 5 deg. of nos. to the right and 20 deg. of opposite bank and allowed the aircraft to recover levels off. There was no apparent tendency for the maneuver to become dangerous and after about four cycles the Dutch roll had changed to a barely perceptible amplitude. This maneuver was repeated at 15,000 ft. and although damping was not quite so rapid, the aircraft recovered from the induced maneuver in a satisfactory time and manner. There was no yaw divergency exhibited in the aircraft since it was awaiting autopilot installation of which the danger is past.

Stalls Performed

Power on and power off stalls in the clean and landing configuration were performed and all aspects of these maneuvers were satisfactory from the maneuver to become dangerous and after about four cycles the Dutch roll had changed to a barely perceptible amplitude. This maneuver was repeated at 15,000 ft. and although damping was not quite so rapid, the aircraft recovered from the induced maneuver in a satisfactory time and manner. There was no yaw divergency exhibited in the aircraft since it was awaiting autopilot installation of which the danger is past.

Only about 5 kt. warning is given before the onset of buffet and the roll at 98 kt. IAS. Airframe stall warning, although not yet installed in SR-71s, will be installed in all SR-71s. A similar low stall buffet margin has been experienced in other jet transports in comparing high lift devices.

Engine-out conditions were simulated at 10,000 ft. with the engine rate of two engines out on the same side being tested with no difficulty. Even with maximum continuous power on two engines, the unpowered third one is handled with no difficulty and without any bank angle. Buffer-hand corner is very handy at this point and forces 50% for full flaps—are not too high to be held in a gear for the length of time required for a manual or other type maneuver. Power gradient on the stabilizer is positive, i. e., increased de-

flexion requires higher force.

Following a simulated two-engine-out scenario, the aircraft was flown to 15,000 ft. Check schedule read out to hold 140 kt. until Mach 58 is indicated (around 25,000 ft.), then a constant Mach number of 58 is followed to altitude. Certificated climb limit is 41,800 ft.

Power was left at maximum continuous 97% rpm, and the aircraft allowed to accelerate to maximum normal operating speed, V_{max} of Mach 59. The level flight acceleration permitted a demonstration of the speed stability system installed on all SR-71s, which automatically limits the aircraft in speed changes, especially near the limiting

speed number. Mach number. Therefore, in speed increases, the speed stability system, through inputs supplied by the "q" sensor, trips the aircraft nose up so that the pilot must raise nose down to maintain level flight. The reverse is true if the aircraft decelerates.

Similarly, should the aircraft nose up or down from a nose condition at cruise, the speed stability system will tend to bring it back to level flight. A normally stable aircraft would continue in the direction in which displaced, despite increases or decreases in speed. A negatively stable aircraft would diverge and pitch further from the initial displacement altitude. These points are that the SR-71 has positive speed stability

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THEY RLY ON RADIATION FOR MEGAWATTS AT MEGACYCLES

Radiation at Stanford (formerly Leventhal) designs and builds high-power radar and communications transmitters, modulators and power supplies. This 30 megawatt transmitter for radar and component testing is typical. It demonstrates a unique capability for solving the special problems of superpower RF.

Two major design considerations in superpower RF equipment are performance and safety. In this unit—as in other Radiation-built systems with peak power to 100 megawatts and frequencies to 40,000 megacycles—special circuitry operates at microsecond speeds to prevent damage to the equipment. It includes five sub-assemblies with remote console containing all controls, interlock indicators and monitoring on oscilloscope.

This capability of Radiation at Stanford is being utilized today by many prime contractors for advanced defense systems, and by makers of high-power commercial equipment. If you work with megawatts at megacycles, you can rely on it, too, for non-equivalent solutions to your problems. Write Radiation at Stanford, Dept. AWP-5, 5300 Hamover Street, Palo Alto, California, for detailed information.



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but not to the extent deemed desirable to increase critical view of landing. Mark readings where "bad" occurs, so it does not obscure all sweeping info.

Although positive speed stability is required of all aircraft, its value is proved on large jet aircraft with wide speed ranges in definable wing plan. Speed stability was more important in the case of deep-stroke-swing flying than it is today when attitude flying is the order.

Forward stabilizer technique was reversed on the descent while IAS was fairly high to show the effect of spoiler deflection on pitch angle. Deploying only the inboard spoilers causes the aircraft to pitch down, whereas the outboard causes a pitch-up. To avoid confusion in terms of categories, a switch on the center pedestal aft of the speed brake handle controls which set of spoilers are activated. Center position is for instantaneous operation, forward position is for nose down and aft position is for nose up. It is unnecessary for the pilot to make any mental calculation as to which set of spoilers produces pitch in what direction since the switch selects the proper set.

Engineered descent, although not demonstrated on this flight, can be accomplished in rapid order should the accident demand due to engine or engine-inoperative or other difficulty. From maximum altitude of 41,000 ft., descent can be accomplished at the rate of 16,000 ft./min. With all engines at idle, main gear and spoilers can be extended and descent team ready to bring the aircraft to an on-glide altitude in slightly over two minutes.

Maximum internal operating speed, V_{max} , was reached at 23,000 ft. with the aircraft in level flight. Power was maintained at 97% and winged was still maneuvering at 591 kt. appeared indicating that excess power for greater speed still was available. At V_{max} , Mach number was .89, indicated airspeed was 591 kt. for a true airspeed of 510 kt. or 620 mph.

The 338 then was flown to Ontario Airport where landings are permitted by Coastar pilots because approach conditions at Lindbergh Field are less than ideal. Although some difficulty was encountered by this pilot in adapting to the special forces which resulted on the aircraft to increase control forces, little difficulty was experienced in landing the 338. At this time, the flight engineers calculated the gross weight at 115,000 lb. and the load showed that reference speed, V_{ref} , was 124 kt.

Twelve patterns were entered at 190 kt. with flaps at 30 deg. with gear down. Landing gear is in the position assumed good with lateral response sufficient to give the aircraft a solid feel. Full flaps were lowered on the final approach and the airspeed reduced to

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MIL/SPEC

GM-07-59-2617A

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A veritable thicket of specifications has grown up around radio frequency interference measurements. Specification GM-07-59-2617A appears to be one of the thickest. If you are having problems implementing this, or are experiencing any other difficulty connected with RFI, contact the INTERDICTION Group from Capehart.

INTERDICTION (for Interference Detection and Interdiction by Countermeasures Team) is a unique service. It begins with the numerous field studies our engineers were carrying out. It grew into a series of mobile RFI measurement vans, an expanded force of engineers, a manual on RFI prediction by mathematical procedures, experience of all current military and industrial communications/electronic equipment, and formal organization into a team led by Dr. Joseph Vogelstein, widely-known authority on RFI detection and elimination.

The engineers from INTERDICTION are completely competent to aid in establishing: systems analysis, design limitations, criteria and test procedures. Follow through by INTERDICTION engineers in the actual performance of these tests assures complete implementation of GM-07-59-2617A or any other relevant MIL Spec*. They have performed numerous systems and site analyses resulting in the prediction, detection and elimination of interference at such complex sites as Cape Canaveral and Vandenberg AFB, frequently before of interference occurred. They can offer you studies of this magnitude, or of very limited application, depending on your needs. INTERDICTION possesses the men, the vans, the material, and the experience to analyze a complete proposed missile system, an individual site, or a single piece of installed equipment. The "package" can be tailored to the requirement.

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Capehart's INTERDICTION offers the first world-wide packaged service to analyze and counteract radio frequency interference. It also provides for elimination of electromagnetic radiation hazards to personnel and materials such as ships, aircraft, fuel. All service is performed in compliance with applicable MIL Specifications such as that noted. To avail yourself of these critical services, contact:

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Bell's all-weather aircraft landing system increases operational capability of navy carriers

Newly aircraft now will land more often and with greater safety on 10 modern aircraft carriers because each carrier will have Bell's new AN/SPN-10 All-Weather Carrier Landing System aboard.

SPN/10, developed and produced for the Navy by Bell Aerospace Company, makes safe landings possible in first weather or at night, even in heavy seas.

Proved out in more than 4000 completely controlled landings on both airtail and carrier deck, the SPN/10 provides vastly improved carrier-controlled approach capability using stabilized glide slope information, ship motion compensation and improved precision radar.

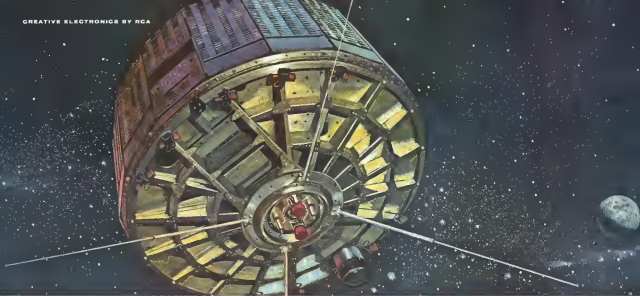
When a pilot enters the electronic "window in the sky" up to four miles out from the carrier, the new Bell system gives him a choice of three modes of operation: a fully-automatic "hands-off" landing, a semi-automatic cross-pointer approach or a talk-down GCA-type approach. Built into the system are features such as automatic or manual wave-off should conditions momentarily prevent a safe landing.

A major element in the Navy's All-Weather Return to Carrier System, the SPN/10 represents an important contribution by Bell Aerospace to the Navy's positive efforts to improve aviation safety and operational usage.

For more information, write:



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Incorporating revolutionary and advanced electronic equipment, TIROS was designed, developed and built by RCA's Astro-Electronics Division for National Aeronautics and Space Administration. Within its small circumference are miniature TV cam-

eras, tape recorders, TV transmitters, command receivers, firing mechanisms, heaters and telemetry equipment. In addition, it carries new scanning and non-scanning infra-red Sensing Devices, developed by NASA, to measure and record the heat radiation of the earth and its cloud cover, and a revolutionary new Magnetic Orientation Device to capitalize on the effects of the earth's magnetic field and maintain favorable orientation of the satellite for long periods.



RADEWS—RCA Electronic Systems are being employed by the Army to detect and identify objects in the sky and on the ground.



DRAP—A 100-ton ship, the *DRAP*, is being used to test the Navy's new radar system.



ATLAS—RCA developed the radar and search system which automatically detects and tracks objects in the atmosphere.

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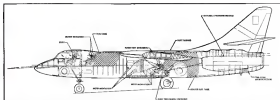


On the 50th Anniversary of Naval Aviation the Navy is serving notice it is ready to meet the challenges of the next fifty years. For its ability, search and rescue missions — rescuing grateful Navy lives — the Navy can call on the all-weather, compact, high speed HUZK-1 Kaman SEASPRITE.

The SEASPRITE's advanced design features make the Kaman HUZK today's answer to tomorrow's requirements. By its ability to operate off ships of the fleet as small as the destroyer, the HUZK-1 provides the Navy an all-purpose helicopter with important ASW capabilities.



THE KAMAN AIRCRAFT CORP., BLOOMFIELD, CONN.



RADICAL MODIFICATION of WB-66D test aircraft will include installation of boundary-podded GE J79 engines under tail to replace wing-podded Allison J73 engines in the original plan. New engine installation will make room for pumps to power the LFC system.

WB-66Ds to Test Laminar Flow Control

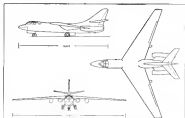
By Russell Newton

Los Angeles—Northrop Corp. is currently redesigning two Douglas WB-66D weather reconnaissance airplanes to demonstrate the company's laminar flow control (LFC) system under a three-year, \$10-million contract from USAF's Systems Command.

LFC is a suction-type boundary layer control system drawing air through porous slots on all the surfaces and wings of the wing and is to be operated in the cruise portion of flight. It is powered by compressor bleed-air from propeller engines and is expected to improve the range, endurance or payload of large aircraft by as much as 90% for a given fuel consumption by eliminating up to 80% of the friction drag on the wing. In turn, this will allow economical use of higher-speed ratio wings to cut drag due to lift and achieve maximum total drag.

The radical modification of the WB-66D test aircraft will include installation of boundary-podded General Electric J79 engines under the tail to replace wing-podded Allison J73 engines in the original airplane. The new engine installation will make room for the wing-mounted suction pumps to power the LFC system. The pumping system is being designed by AERResearch Manufacturing Division of Garrett Corp. under a \$1-million USAF Systems Command contract. The aircraft will be derived from existing AERResearch units.

To meet the requirements of the LFC installation, a new wing is being designed for the test airplanes. It will have a span of 93.5 ft. instead of the original 72.5 ft. and its area will be 1,250 sq. ft. rather than 760 sq. ft. The completely new wing is required



NEW WING is being designed for the Douglas WB-66Ds. It will have a span of 93.5 ft. instead of the original 72.5 ft. and its area will be 1,250 sq. ft. instead of 760 sq. ft.

In the accuracy of maintaining straight flight strength while incorporating the ducts and slot slots of the LFC. Northrop gave the new wing an aspect ratio of 7.0 instead of the original 6.75 because the lower friction drag with LFC dictated a higher optimum value. The effect of higher aspect ratio is to cut drag due to lift.

Accommodations and instruments for two flight test engines will be installed in the former bomb bay or equipment compartment. Fueling fuel tanks also will be modified.

Each of the two test airplanes will have two identical LFC systems, one on each wing. Each LFC system is powered by a pair of regenerative driven axial flow turbo-pumps. A two-stage turbo-pump draws the leading edge and upper wing surface boundary

layer air through slots and feeds it to a three-stage high pressure turbo-pump along with air from the lower wing surface and trailing edge slot slots. The air from the high pressure compressor and the turbine exhaust are then ejected to the rear to provide additional thrust. The two units can be controlled independently for a wide range of operating conditions.

Exhaust from each turbine and compressor will add 160-500 lb. thrust.

Northrop plans to operate the LFC during takeoff and landing, though the system is optimized for cruise conditions and will add little or nothing to the low-speed performance of the airplane. The main reason for this decision is to keep the slots from being clogged by dirt.

4 new static inverters specifically designed for aircraft and missiles



Hamilton Standard has developed a new line of 100-VA and 500-VA inverters that establish an important increase in inverter reliability and performance. The units are specifically designed for airborne use. They possess extremely high overload and short circuit capacity and offer wide operating ambient temperature ranges. The basic design is modular and utilizes silicon transistors throughout. The products are small, compact and deliver high over-all power-to-weight ratios.

AS MAJOR OR STANDBY AC POWER SOURCE, these new inverters can now replace much of the rotary equipment presently in use on aircraft and missiles for supplying power to:

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RATING PART NO.	500 va 6064AB	500 va 6064AB	100 va 6064AB	100 va 6064AB
Output Voltage (Nom.)	115 v	115 v	115 v	115 v
Frequency	400 (±1.0%)	400 (±1.0%)	400 (±1.0%)	400 (±1.0%)
Power	500	500	100	100
Frequency Protection	No	No	No	No
Temp. Range	-50° to 125°	-50° to 125°	-50° to 125°	-50° to 125°
Input Voltage (Range)	12-28 v	12-28 v	12-28 v	12-28 v

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Navy Urges Stress on Sea-Launched Missiles

Washington—Navy officials urged stress on developing ships as missile launching platforms while the Defense Department and the National Aeronautics and Space Administration considered the sea launch approach is not currently practical.

Vice Adm. John T. Flanagan, deputy chief of naval operations for development, told the House Science and Astronautics Committee that a floating drydock had posed a practical launch site in both off Johnston Island. He and others showed the drydock, stationed by 100-ft-long jacks that pass against the bottom of the sea, could be moved by launching at a cost of \$7 million, compared with \$21 million for constructing the same type equipment on the island.

Recommending more emphasis on sea platforms, Adm. Flanagan said such mobile facilities would create fewer political problems than land bases and would offer the advantages of safety, flexibility and economy.

John H. Kufahl, deputy director of Defense research and engineering, responded it would be an advantage to have both permanent and mobile launch sites located in open vehicles could be launched directly into equatorial orbit rather than "dangle" from existing bases. But the cost of an operational site "cannot economically be justified at this time," he said. Basic within the U.S. an adequate for current program, he said, adding that both the

Information foundation

Feeling and using information development is scientific themselves is perhaps the most crucial problem of optimum scientific progress.

Reg. Gen. Benjamin G. Helms, commanding USAF's Cambridge Research Laboratories, makes the point that way in Perspective, a quarterly report from General Accounting Laboratories.

"Let's consider a hypothetical scientist named Dr. Jones. Dr. Jones is often in command himself, he is not 30 his progress rapidly. He has no equally named job, he has to attend no committee meetings, write no reports or letters, answer no telephone calls, perform no actual work tasks, or even talk to anybody. All he has to do is to try to keep up with the literature of his own field. Dr. Jones was read two papers at home and he wrote a letter home. On 1 January 1959 he began writing all papers of classical interest published in 1958. On 31 December 1959 he found himself too weary to read in his reading."

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Defense Department and NASA are keeping the capital into question under contract to us.

Milton W. Rorer, deputy director of NASA's launch vehicle program, said: "NASA has no requirements at the present time for the use of ships, floats or associated platforms to support vehicle programs now in flight. Future programs will be concerned with nuclear equipped vehicles and with very large boosters. A study is about to be initiated within NASA to determine launch site requirements for studies in these categories."

Hydrazine Fuel Being Produced for Titan II

Soluble-Volatile products of its design, one of the two non-organic storable fuels to be used on the Titan II missile has begun at the Air Force plant at a recent Virginia. The new \$15-million plant is operated by the Ohio Methylene Chemical Corp. under a three-year \$25 million contract.

Ammonia (liquid water) hydrazine is an organic fuel made from carbon, ammonia, chlorine and ammonia. Its suitable combination with an equal quantity of unsymmetrical dimethyl hydrazine (UDMH), manufactured by the Food Machinery Corp. The composite fuel burns independently with the oxidizer nitrogen tetroxide, made by the Allied Chemical Corp.

Specific impulse of the Titan II propellant is about 252 sec. compared with 286 sec. of Titan I, which uses liquid oxygen and RP-1. The storable propellants are denser, heavier, and allow for longer burning time at the Ascent Control system. Thrust of the Titan II is about 450,000 lb., compared with 350,000 lb. of Titan I (AWF June 77, p. 36).

The highly automated Solvich plant, requiring about 100 men as a 24-hr. production schedule and the fuel is being transported to Ascent's Sacramento, Calif., test facility where Titan II engines are being test fired.

USAF to Train Space Pilots at Edwards AFB

Washington-USAF plans to expand the Experimental Flight Test Pilot School to include a special 24-week course for space pilots.

The school, located at the Air Force Flight Test Center, Edwards AFB, Calif., will have a course distinct from the one now given test pilots and only a selected few graduates would be chosen.

Instruction will include familiarization with integrative training of all test controls and validity under dynamic conditions.



Blue Water Designed for Mobility

Blue Water add fuel tank-to-surface mobile, as what appears to be offshore mobile, has been designed for no transport and can be loaded aboard air crew transporters mounted on a flat truck. Mobile has also type on forward concern being wrong most, probably for flight with control. French Sirocco, the manufacturer claims mobile is independent of ground control and is immune to enemy countermeasures. Note mobile being device between others.

PRODUCTION BRIEFING

Seahawk flight bomber, designated SVA, was captured first 111 sec at Marshall Space Flight Center and developed 1,512,000 lb. thrust.

Navy Sikorsky HO4S helicopter has completed its carrier suitability trials, part of the Board of Inspection and Survey trials. It is scheduled for introduction to the fleet later this year.

Damage assessment center, which would prevent nuclear warhead destruction to be made rapidly, will be built under Defense Advanced Support Agency contracts including \$3 million to the Systems Development Corp., \$1.5 million to the Control Data Corp., and \$1 million to Raytheon-Woodbridge Division of Thompson Ramo-Woodbridge Corp.

Martin Earth-Moon Study

Washington-Martin Co. has been awarded a \$75,000 contract to study methods of manual earth moon transfer, the manual space flight program, now considered the Project Apollo follow-on.

National Aeronautics and Space Administration contract with for a study of problems in lunar landing and an orbital survey for three mo., 1968, stay on the moon for three, and a permanent moon base to house 16-18 men.

Navy Bureau of Ships has ordered design of integrated shipboard electronic systems in which major subsystems must be reconfigurable and installed as a single structural unit (NAV May 8, p. 21). Collins Radio's Alpha Corp. will work on a contract for a guided missile frigate under a \$1.4-million award. Electronic Boat Division of Coastal Dynamics has a \$170,000 contract for a nuclear-powered attack submarine to test, and a Hercules Corp. contract for \$170,000 covers a similar effort for a guided missile escort vessel.

Justice Department has filed a suit for \$32,000 against a Norwegian shipping company for damages to the Sibiria barge. Polonium is a collection with a Norwegian freighter last month on route from Houston, Ala., to Port Canaveral, Fla.

Air Force Systems Command has awarded a \$7-million contract to the Armer Research Foundation to develop methods of analyzing electronic intercepts from defense ranging from wide-area to large radar. Work will be done through the newly established Electronic Security Company Analysis Facility at Annapolis, Md.

Navy has awarded a follow-on production contract for \$31,400,000 to the Sperry Gyroscope Co., division of Sperry Rand Corp., for the SPG-55 Torpedo automatic missile guidance radar air test.



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NEW MAGNETIC HOLD-IN SWITCH

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"YET" SERIES SWITCHES

THE "YET" SERIES includes models with either double pole double throw or single pole double throw capacity. Toggle type solenoid mechanisms are available for snap, snap or snap or snap. "YET" Switches are also available with sealed lead wires extending at a 50° angle from the base. Where safety requires, a pull-to-release lever is available which is locked out of emergency position.

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The precision, double pole double throw switching unit and solenoid are contained in one compact unit. The "YET" measures approximately 2 1/4" behind the panel and one inch

in diameter. This switch requires no auxiliary relays or other remotely controlled switches—another saving in space.

Switching unit and solenoid are sealed within an enclosure which has been evacuated and filled with inert gas under pressure, which insures reliable operation, regardless of changes in atmospheric conditions. An electrical unit at the base of the toggle lever prevents entry of dust or moisture. The "YET" meets minimum test requirements of MIL-B-1272, procedure I. See the Yellow Pages for the nearby MICRO SWITCH Branch Office or write for Data Sheet No. 121.

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Page 3 of 3

• Dallas, Tex., probably shows the least sign of an upturn. A Piper sales outlet confirmed that the market had

48



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Modulation rates of .005 to 1000 cps in five ranges are provided in sinusoidal, step, and ramp functions either directly or in suppressed carrier form. Modulation frequency accuracy readings of 2% are possible.

Other important unit specifications are:

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Use of Vought Electronics Servo Analyzer has been demonstrated successfully with Titan and Minuteman missiles as well as in industrial laboratory applications. It is available in both bench and rack mounted models.

For more complete information about this versatile instrument, contact:

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dropped in drastically only this year that he felt that he could no longer control his business and his family in handling most aircraft exclusively. Because he was good November through February, he started, then fell off several other President Kennedys and other Administration spokesmen emphasized the overall effects of the business recession.

He indicated that not a single new Piper airplane has been sold in this area this year, and that sales of new airplanes of all makes could be counted on the fingers of both hands.

Reeds Aircraft sales in five areas in the first quarter of the year probably have been the slowest since the end of the war, a representative at one of the manufacturers' centers here is quoted, but he said that there have been definite signs of improvement in the past few weeks, with several new aircraft sales having been recorded and additional sales looking fine in the near future. Sales are expected to be most noticeable in the Queen Air, Buzco and Bonanza.

Excess Overhead

A Cruise seller in this area reports outdated accounts of 1962 and said aircraft inventory is a reduction of about \$100,000 in this category since the beginning of the year, but confirmed that the inventory had been sold. A major concern has been in reducing what he considers excess overhead, paying personnel and reducing sales costs. Lack of good customer prospects are said to be the main factor in affecting the cost of standing airplanes down and depends primarily upon advertising.

Much of the sales loss in this area is attributed to "over-depreciation" of aircraft brought from established aircraft and equipment sales and service organizations and selling up shop in the area field as their business collapses. With much lesser overhead in many areas this picture is significantly different by the larger established outlets.

Debonair Tip Tanks Add 400 mi. Range

PAA approval of tip tanks for the Debonair has been given to Flight Extensions, Inc. Shoshoni, Colo., builder of aircraft wingtip fuel tanks. The tip tanks are available in 10, 20 and 40 gal. and are installed in the Debonair fuselage without requiring structural changes in the aircraft.

With a capacity of 12 gal. each and an empty weight of 81 lb., each tip tank will add approximately 400 mi. to the operating range of the Debonair.



POTEZ 840 is powered by four Turbomeca Astazou turboprop engines, each developing 512 hp. Maximum speed is 555 mph.

U.S. Market Seen for Potez 840 Turboprop

By Robert E. Farrell

Potez 840 four-engine turboprop executive/transporter aircraft probably will be marketed in the U.S. by Turbo Flight, Inc. Chicago at a price just below \$500,000.

Negotiations currently are under way in Paris between the private French aircraft builder, and Don Royce, Turbo Flight president. Royce told Aviation Week that he expects agreement to be reached early which his company would get exclusive North American sales rights, with an option on sales rights in South America.

In action, Turbo Flight will assume complete financing of sales and after-sales programs in North America. Royce and he planned to test a second Potez 840 prototype, slated to be completed late this year, and test U.S. demonstration purposes beginning in February, 1963. Producers models are currently being flown for early 1963 delivery (AW Apr. 8, p. 34).

The Potez 840 made its first flight Apr. 29. The aircraft is powered by four Turbomeca Astazou turboprops each delivering 510 hp as listed in a brochure, that 840 will carry up to 24 passengers. In eight-passenger executive configuration it will cruise at about 325 mph with a range of 3,200 mi. Operating costs, according to Potez, work out as low as 90 cents a mile, based on 600 hr. yearly utilization.

A second prototype slated for purchase by Turbo Flight will have additional range up to 7,500 mi. This will be achieved by enlarging present wing tanks and by adding (wingtip tanks) Potez claims that with this range the 840's U.S. market in first row of delivery—1963—should be about 45 aircraft. On the production side, Potez currently is dealing with the Republic of Ireland on site facilities are not found in France. The entire Potez 840 project

has been jointly financed by Potez and the French government. It is reported the Max Holste twin turboprop leader, the Super Bonanza (AW Apr. 14, p. 101).

The Potez company itself hasn't enough production capacity, or orders to build the 840 itself. Hence it is looking elsewhere, including Ireland, where the company has production facilities in aerodrome fields. The Irish government reportedly is anxious to have Potez establish an aircraft factory in order to ease the country's unemployment problem.

The aircraft's fuselage is laid out with the main gear retracting sideways into the wing, and the wingtips forward into the fuselage. Wing efficiency is added by having the wing join down close automatically when the wheels are retracted.

Potez factory space runs between \$150,000 and \$180,000. The U.S. price of \$500,000 includes complete radio aids, weather radar and pre-flight U.S. duty.

Turbo Flight's interest in Potez aircraft came about three years ago. The U.S. company originally was interested in sales rights for the two-engine turboprop executive/transporter prototype offered by Dassault-Breguet Aviation.

Three new French companies dropped their interest when the French government refused to help them finance it.

The first Potez 840 prototype was built in 18 months. The company decided on four engines in order to maintain satisfactory flight control by reducing asymmetrical effects resulting from engine failures. A four-engine configuration, the company further claims, offers other benefits, ability to shut down two engines in holding patterns, to maintain higher rates of climb with an engine out and, finally, four engines give the user an extra percentage for maintenance in operation of essential systems.

Potez 840 Specifications

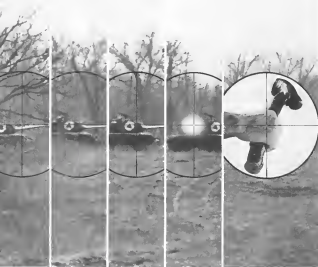
Span	105 ft. 0 in.	65 ft. 0 in.
Length	112 ft. 0 in.	112 ft. 0 in.
Height	37 ft. 0 in.	37 ft. 0 in.
Wing area	277 sq ft.	277 sq ft.
Max. weight—14 seats	167,400 lb.	167,400 lb.
16 seats	177,200 lb.	177,200 lb.
Power loading	9.0 hp/lb.	9.0 hp/lb.
14 seats	8.25 lb./hp.	8.25 lb./hp.
Empty weight	109,900 lb.	109,900 lb.
Fuel capacity	407 U.S. gal.	407 U.S. gal.

Potez 840 Performance

Max. speed at 20,000 ft.	515 mph	515 mph
Cruise speed at 20,000 ft.	325 mph	325 mph
Takeoff rate	1,700 fpm.	1,700 fpm.
Takeoff rate of climb	1,440 fpm.	1,440 fpm.
Rate of climb	36,500 ft.	36,500 ft.
Climb, max. engine	52,000 ft.	52,000 ft.
Takeoff roll (standard conditions)	1,600 ft.	1,600 ft.
50 pps.	1,600 ft.	1,600 ft.
24 pps.	2,350 ft.	2,350 ft.
Landing roll (with fuel reserves)	2,675 ft.	2,675 ft.
Over 50 lb. reserves—24 pps.	2,220 ft.	2,220 ft.
Power units	4 Turbomeca Astazou turboprops of 512 hp.	4 Turbomeca Astazou turboprops of 512 hp.

SHILLELAGH

U.S. Army Missile System



The SHILLELAGH is being developed for the U.S. Army under the overall direction of the U.S. Army Ordnance Corps.

The United States Army SHILLELAGH surface-to-surface guided missile—like its Irish namesake—will be simple, reliable, . . . lethal. Against enemy targets—moving or stationary—SHILLELAGH's accuracy and firepower will provide the U.S. Army a devastating new weapon that kills with a first-round probability approaching unity . . . and at ranges never achieved in antitank warfare. SHILLELAGH is now under development at Aeromatronic, prime contractor on this advanced weapon system.

AEROMATRONIC DIVISION *Ford Motor Company*, DEFENSE PRODUCTS GROUP
FORD ROAD, NEWPORT BEACH, CALIFORNIA



SHILLELAGH is one of many advanced programs currently under development at Aeromatronic's new, million-square-foot Engineering & Research Center at Newport Beach in Southern California.

Write for information about Aeromatronic's capabilities and career opportunities now open for engineers and scientists.

De Havilland Modifies Engine for DH.125 Executive Jet

By Herbert J. Coleman

London—Bristol Siddeley's Viper turbojet engine, powerplant for the new de Havilland DH.125 Jet Dragon executive transport, has been modified to include a new stage, boosting total thrust 500 lb. from the Mk. 11 production version.

Engine, designated Viper Mk. 20, has a thrust of 5,000 lb., compared with 2,500 lb. produced by the Mk. 11 version, and mass flow has been increased from 44 lb./sec. to 52.5 lb./sec. Specific fuel consumption has been cut from 1.07 lb./hr./lb. to 0.955 lb./hr./lb.

The Jet Dragon, first de Havilland entry into the pure jet executive field, will go into production directly from the design stage (AWM Apr. 17, p. 15) and a mockup now is under construction at de Havilland's Hatfield facility. Engines are mounted aft on the tail fin section.

By adding the new stage on the front of the compressor section, Bristol Siddeley said it also has improved thrust performance by decreasing turbine entry temperature (TET) to about 1,315°C. Further developments may include a two-stage turbine and an aft fan to extend application of the engine. Mk. 11 version, which powers the Nimrod MR.125 trainer, has aerodynamic compressor driven by a single stage, turbine with an smaller combustion chamber of the varying type. Mk. 20 now is flying in the Harrier jet Proton and Nimrod for operational experience data.

Engine has been used in company with the Frederick Knight design, the Jet Provost trainer, Diamond Viper, the Bell X-1 V-STOL, research plane and the Sud Aviation Trident reconnaissance.

De Havilland will build an initial quantity of 30 Jet Dragons, but has not yet awarded the price or performance details. It probably will cost as much as \$400,000 and is designed to carry a two-man crew and six passengers at speeds up to about 1,500 mi. at speeds up to 500 mph.

Jet Dragon configuration, with its T-tail and aft-mounted main jets, is similar to the de Havilland Trident and BAC 117 transport line. The com-



Viper Mk. 20 for DH.125 weighs 575 lb., is 66.67 in. long. Projected follow-on, after 80,000, would have 3,700 lb. thrust.

pany will submit the airplane to the British Air Ministry for possible use as a small transport and jet trainer for its cross. First order would be for 10 Jet Dragons, but the Ministry is known to be waiting for the first plane to fly before making any move.

De Havilland is financing the project with its own funds, for delivery is expected in 1963, and has discussed "control within bounds" for development of an aircraft it believes will remain current for 20 years.

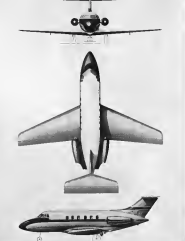
Main factor in the design effort has been to keep the Jet Dragon capable of operating from short runways and at "very moderate" approach speeds, but retaining good landing characteristics at both high and low speeds.

Experts say the construction has been kept simplified, because a long-built in one piece, parallel over an inferential portion of its length. It will have an unobstructed circular cross section. Wing will be built as a single unit from tip to tip, and it will run unobstructed under the main fuselage section.

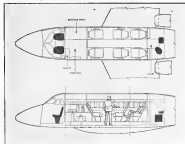
Top surface of the wing will be curved to achieve the linearity. The wing has a moderate degree of sweep and a fitted with double slatted flaps. Spoiler brakes also will be installed. Controls will use a power-assisted because maximum cruising Mach number will not greatly exceed 0.7. Gross weight is about 14,000 lb. The computer says that on the basis of aircraft noise data, rate of operation of the Jet Dragon will be about the same as those of the piston-powered Dove, at about 16 cents per mile.

Designing equipment will be fitted to the Jet Dragon, and Bristol Siddeley has provided a driving system for the Viper, in line with the all-weather requirement.

The Jet Dragon is the 125th airplane designed by de Havilland, hence its number designation. It is named for the 1912 vintage DH.124, first de Havilland two-engine transport.



DE HAVILLAND Jet Dragon will have a T-tail, moderate wing sweep and two Viper Mk. 20 turbojet engines (5,000 lb. thrust) mounted aft. The aircraft is designed to carry a two-man crew and six passengers (below).



De Havilland DH.125

Specifications	
Length	41.5 ft.
Span	44 ft.
Height	34 ft.
Wing Area	342 sq. ft.
Gross Weight	15,000 lb.

U.S. Business & Utility Aircraft Shipments

(March, 1961)

Make & Model	No. of Units	Net Shipments
 Aero-Commander 440A	1	\$1,000,000
 Beechcraft 40	1	\$1,000,000
 Beechcraft 400	1	\$1,000,000
 Beechcraft 400A	1	\$1,000,000
 Beechcraft 400B	1	\$1,000,000
 Beechcraft 400C	1	\$1,000,000
 Beechcraft 400D	1	\$1,000,000
 Beechcraft 400E	1	\$1,000,000
 Beechcraft 400F	1	\$1,000,000
 Beechcraft 400G	1	\$1,000,000
 Beechcraft 400H	1	\$1,000,000
 Beechcraft 400I	1	\$1,000,000
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Interval amplitude has speed 0.1" apart which can be blown from 1, 1.5, 3, 5, 10, 15, 30, 60, 120, 240, 480, 960, 1920, 3840, 7680, 15360, 30720, 61440, 122880, 245760, 491520, 983040, 1966080, 3932160, 7864320, 15728640, 31457280, 62914560, 125829120, 251658240, 503316480, 1006632960, 2013265920, 4026531840, 8053063680, 16106127360, 32212254720, 64424509440, 128849018880, 257698037760, 515396075520, 1030792151040, 2061584302080, 4123168604160, 8246337208320, 16492674416640, 32985348833280, 65970697666560, 131941395333120, 263882790666240, 527765581332480, 1055531162664960, 2111062325329920, 4222124650659840, 8444249301319680, 16888498602639360, 33776997205278720, 67553994410557440, 135107988821114880, 270215977642229760, 540431955284459520, 1080863910568919040, 2161727821137838080, 4323455642275676160, 8646911284551352320, 17293822569102704640, 34587645138205409280, 69175290276410818560, 138350580552821637120, 276701161105643274240, 553402322211286548480, 1106804644422573096960, 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or glass. Possibly, he said, the ground state and excited energy levels of an atom could be used as storage positions with switching between logical conditions being optically induced transitions from one energy level to the next. Transition times between energy levels frequently are on the order of a nanosecond or shorter. Still faster switching times might be attained, Gagli said, by using electron spin resonance techniques.

- **Transmittance lines**—Light entering a fiber is transmitted from point to point within the computer by optical fibers, much as standard point-to-point wiring is used in a conventional computer. The fiber is a glass tube that is bent so that light entering one end would be aimed where the other end is. A fiber would be coated with a glass whose index of refraction is higher than the fiber's, so that light entering would not escape.
- **Decorative elements**—Decorative lighting, such as diode pipes and color lights might be obtained by combining two beams of circular, polarized light.
- Three types of polarized light beams—circular right and circular left and linear—can be combined to produce many other light effects. A Kerr effect could function as a gate to convert an electrical impulse to an optical signal and a photodiode might be substitution for monitoring optical signals into a computer. The Kerr effect is the basis for optical output amplifiers.

Storage Device

One useful storage device employing quantum transistors in a gas was described by Clapp. A small vessel with two electrodes manipulates two gases, one with known metastable states, the other with an unknown potential before the measurement. The unknown gas shows up as a series of energy distributions, most of these atoms in the lowest energy as ground state, the cell is regarded to be in the lowest state. If a voltage pulse is then applied, the atoms are excited to higher states, those made available by the stimulation of one gas, to excite the atoms of the other gas into higher energy states. Some of these will drop down into the metastable state, remaining there for a read-out is applied in drop-out mode. The gas is then pumped out, then used, again.

If the cell were in the "rest" state during interrogation, Clapp points out, the energy level of the ground state electrons would be shifted slightly without producing a significant reduction

The same effort might be brought about, Clapp continued, by adjusting radiation into the cell to stimulate transitions to the upper energy levels and then releasing transitions of various

Several existing memory cells could

**WINBOS**

Nimbus is the second step in NASA's research and development program to study weather technology. Differing from its predecessor, Tiros, Nimbus will view the Earth at all times.

Orbit—Working approximately 650 lbs., Nimbus will circle the earth every 100 minutes in a 600-mile-high polar orbit.

Beta Application:Cloud pictures and other information will be played back on command to U.S. meteorologists at Fairbanks, Alaska. Foreign scientists, also, will be invited to participate in the program.

Control and Stabilization—A specially built system will keep TV cameras always oriented toward the earth and permit cameras to view particular sectors of the global cloud pattern.

General Electric's Missile and Space Vehicle Department will provide systems integration for Nimbus, and will develop the control and stabilization system. MSVC is a department of the U.S. Defense Electronics Division.

GENERAL ELECTRIC

NIMBUS will be America's next-generation weather satellite in space. Continuously viewing the globe with TV cameras and other sensors, Nimbus will help men forecast the weather and learn more about its causes. General Electric's Missile and Space Vehicle Department is constructing the space craft and providing systems integration for the system designed by the National Aeronautics and Space Administration.

GENERAL ELECTRIC



Nimbus is the second step in NASA's research and development program to study weather technology. Differing from its predecessor, Tiros, Nimbus will view the Earth at all times.

Orbit—Weighing approximately 650 lbs., *Narwhals* will circle the earth every 100 minutes in a 600 mile-high polar orbit.

Equipment—As many as 6 TV cameras, plus infrared measuring devices, tape recorders, telemetry and command instruments will be contained in the satellite.

Beta Applications—Cloud pictures and other information will be played back on command to U.S. meteorologists at Fairbanks, Alaska. Foreign scientists, also, will be invited to participate in the program.

Control and Stabilization—A specially built system will keep TV cameras always oriented toward the earth and permit cameras to view particular sectors of the global cloud pattern.

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be assembled into a large memory by joining two glass plates in a gaseous environment so that the upper plate, containing many spherical ball contacts, encloses the gas. The lower plate contains electrodes for evicting the gas in such events during read and write. The induction current which occurs when a stored logical one is detected can be led out through optical fibers to a phototube associated with a particular group of bits, Clapp indicated.

The same phenomena is a solid captured might be achieved, Clapp said, in place of a gaseous atom which has certain technological problems, connected with the need for suppressing spurious transitions from upper energy levels to ground state produced in collisions of atoms.

There are a number of other criteria in different some crystals which dynamic factors such as potential well widths, suitable for data storage. One of these, Clapp suggests, is the P center, generally thought to be a lattice point with a missing negative ion. Electrons tend to be trapped by the resulting vacancies, but are rather loosely bound so that they can be freed by external induction or heat.

The dynamics of a memory cell utilizing P center trapping might be as follows. Electrons might normally be below the Fermi level in the crystal band structure, thus below the P center as well. This could be designated the "zero state." By illuminating the crystal, electrons are brought into the conduction band, and if the P center density is sufficiently high, a significant number of electrons would be trapped. The state of the memory, Clapp said, could be detected in several ways. For example, the crystal could be irradiated with short wavelength radiation so an electric field could be applied and thus transition absorption could be observed as electrons return to a valence band.

Another type of memory element might employ an optical mixer with a large number of cells for data storage. In his report, coordinated with Albert H. Meyer, Lescroart outlined the construction and testing techniques employed in the logic and memory circuits of a 1,000-bit thermal diode computer developed under Project Light wave.

Logic circuits for the computer are mounted on 20 mil thick aluminum sheets about twelve thousandths are 775 by 860 mils. Interconnections between wires are made to terminal pads on three sides of each wafer. Components include tunnel diodes and

specifically developed precision current and voltage, 20 mils in diameter and 168 mils in length. Recently, such a cell is deposited over part of the body which is then covered with magnetic film and chosen areas for protection.

In interconnecting wires is a special assembly—a shielded crystal transmission line concept was proved to minimize crosstalk and other problems peculiar to a micro-miniature computer. The transmission line provides a planned path with uniform inductance and capacitance per unit length thereby avoiding signal disturbances the techniques are used at these frequencies.

The RCA approach, Lescroart said, was to mount the modules in a metal channel of a double structure which is made with two or more channel patterns. This structure also supports the wires. The terminal pads of the crystal wafers line up with the channels so that each wire is in its channel until reaching the terminal. Flange-like channels are laid out and the assembly treated to reduce any desired electrical effects. Crosstalk is prevented, he pointed out, by keeping each wire in its channel. Coating the top of the channel with conductive epoxy prevents additional shielding.

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trans signals arriving at two points at different times, two wires can be cut to the longest length, and the excess wire on the shorter path can be cut and fed in at its channel.

Measurements—including characteristic impedance, resistance and loss—were made and found to compare favorably with measurements made in a solid piece of silver-plated brass of the same configuration.



■ **USAF Airbase Avionics Analysis**—An F-4 aircraft and combatable missiles now in the inventory have an average of 16 avionics subsystems per vehicle and each subsystem has an average of 97 contacts, according to statistical analysis made by Majors and reported by W. H. Van Meter during recent National Aerospace Electronics Conference (NAECON) in Dayton. Analysis of the contacts, their functions and characteristics was made to provide guidelines for future modular avionics development. Second phase of USAF avionics program will involve airborne avionics equipment now under development. A breakdown of contact types run at 30 to 40 per cent of weighted current population, is as follows:

- 42.6% Amplifier
- 14.6% Relay and wire jumper
- 9.9% Logic
- 22.1% Frequency translator
- 8.6% Oscillator generator
- 4.9% Filter
- 2.5% Monitor and testing
- 8.5% Miscellaneous

■ **USAF Rogers Molecular Beam**—Although the F-4 has lost some of its capabilities for molecular electron detection (molelectron), a concept which it and Westinghouse Electric pioneered, the USAF recognizes the need for microcircuits using discrete components and integrated component assemblies at least in its interim step to achieve size and weight required for space vehicles.

■ **Recent Molecular Beam Avionics Report**—Recent developments in electronic FETs (field-effect transistors) reported by Westinghouse Electric's R. W. Hendrix at recent NAECON include the following:

- **Tuned amplifier**, using amplifier with a notch filter in a degenerate feedback loop, instead of the conventional feedback loop. Low gain of 10 at 100 MHz. The entire device occupies a size of only 1.5 x 1.5 x 0.03 in.
- **High load amplifier**, three stage, providing current gain up to 10,000 has been constructed.
- **Voltage amplifier**, with impedance to 3 mc.

■ **Optical Pulse Expander Developed**—Optical device for expanding and compressing radio pulses on a pulse-to-pulse real-time basis, using a coherent light processing technique, was reported at NAECON by Lee Skolnick and Alfred Brich of Lockheed Electronics Co. In one experiment described by the Lockheed scientists, a 0.5 microsecond input pulse was expanded to 35 microsecond output using a 1.5-micron semiconductor frequency converter and a 2.5-micron IF coded bandwidth.

■ **Improved Solar Cells Developed**—Gallium arsenide solar cells, which have a higher theoretical conversion efficiency than present silicon cells, have achieved efficiencies up to 14.7% in laboratory samples. R. W. Rauscher of the Aerospace Systems Division's Electronic Technology Laboratory reported at NAECON. Samples were in 5 cm square size. Another promising solar cell development is the use of new polycrystalline materials such as cadmium telluride, which can be fabricated in large structures at relatively low cost. Rauscher said. New binary compounds, such as aluminum antimonide, which are more responsive to solar energy in the 0.2 to 2.5 microns region where the sun's energy is strongest, also are under investigation.

■ **High-Power Magnetron Propulsion**—Magnetron, which uses a novel inverted conical structure, has produced 150 kw peak power at a frequency of 16 kw and 125 kw at 35 kw, in laboratory tests, Lt. M. M. Hall of ASD's Electronic Technology Laboratory reported at NAECON.

■ **New Type Solid-State Device**—New active first terminal solid-state device, whose operation depends upon its capacitive vibration rather than upon current current as in conventional transistors, was described at NAECON by Charles F. Pollock of Catholic University, Washington, D. C. Device, called a solid state electronic, can be used for sensing, timing, memory, without physical contact for detection of electrostatic couplings and is so insensitive for electronic interference. Hall effect and charge pattern sensitive means, Pollock said. The vibrating performance is controlled by back-biasing, diode junction using a voltage provided by a tunnel diode oscillator.

■ **Majors Deloit in Miniature Supplex-Majors**, but, was selected by the industry as the second supplier of discrete models for the virtual guidance/control system for Miniature Majors was shown from 27 firms seeking the role (AVR Apr 24, p. 87). Antares is a micro gate gate contractor on Miniature

NEW FROM WESTINGHOUSE: STATIC POWER SUPPLIES FOR SONAR



Static power packages from Westinghouse supply switching power for sonar. In use shown at right, which will power units for Ede Corporation, needs for packaging present replacement of 13 diodes per unit in less than one minute. Kits to meet any system change or performance can be supplied. This equipment covers M4 P-15736. For help in solving your static power supply problems, you contact your local Westinghouse sales engineer. Or write Westinghouse Electric Corporation, P.O. Box 660, Pittsburgh 30, Pennsylvania.



Westinghouse





NOVEL COMBINATION Antenna-amplifier, in which RF amplifier (in heterodyne converter) is built as integral part of antenna structure in three to six different types. Log-periodic dipoles with tunnel diode distributed amplifiers (left) was developed by Ohio State University scientists. The half-wave dipole (right) using a submillimeter parametric amplifier was developed by scientists at New Hampshire University.

Antenna Has Built-in Receiver Circuitry

By Philip J. Kline

Dayton, Ohio—Antennas for communications, telemetry and radar which has part of the radio receiver circuitry integrated into the antenna's structure, providing improved performance and reduced antenna part, was disclosed here during the recent National Aerospace Electronics Conference.

The new technique is reported to find use in satellites and space vehicles where performance, size and weight are critical factors, as well as in terrestrial applications.

An antenna which contains a heterodyne diode converter that produces an output at an intermediate frequency, called as "antennoverter," and one whose structure contains a diode distributed preamplifier called as "antamplifier" were among the novel types disclosed by John R. Copeland of Ohio State University's Antenna Laboratory. (The report was co-authored by William J. Robertson, also of Ohio State.)

A similar technique, in which a submillimeter parametric preamplifier is built into the structure of a half-wave dipole element of a Yagi antenna for a satellite doppler tracking station (at 185 mc) was described by Albert D. Poul of the University of New Hampshire's Antenna Systems Laboratory. (The report was co-authored by Ronald R. Chalk.)

The new concept in antenna design is a direct outgrowth of recent developments in diode parametric amplifiers and tunnel diodes. Copeland predicted that expected advances in solid-state circuitry and electronics "should soon make possible the integration of as many radio systems, except perhaps

for the output diodes, into the antenna structure."

Working under the sponsorship of USAF's Aeronautical Systems Division in Dayton, Ohio State University scientists have investigated a number of different types of integrated antennas, including the following:

- **Bandwidth spread antennas** with a mixer or tunnel diode that functions as a heterodyne converter to detect the received signal at a new intermediate frequency.
- **Traveling wave antennas** in combination with a traveling wave tunnel diode amplifier.
- **Log-periodic diode arrays** in combination with a tunnel diode distributed amplifier.
- **Parabolic horn antennas** whose resonant elements are used as tank circuits for a tunnel diode amplifier.

Antennoverter Tests

Like Ohio State's tests, an antenna system was built into the feed transmission at the tip of a conical spiral antenna. The spiral, or rotating elements of the spiral, was the section of two concentric cables while the cables themselves served to bring in the local oscillator signal and take out the intermediate frequency (IF) signal.

By varying the frequency of the local oscillator, 34 antenna elements were tested in its desired frequency over the bandwidth.

The Ohio State tests indicated that the antennoverter equipped with a conventional waveguide (Type INSTR) has approximately the same noise figure as a laboratory standard General Radio noise source. Using a tunnel diode, the device exhibits a 7-dB gain

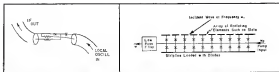
over its performance with the INSTR Copeland said. The gain with signal conversion occurs because of the feed and diode's negative resistance characteristic.

The traveling wave parametric antenna approach, the ideal type of preamplifier by distributing the amplification along the length of the antenna structure itself. This provides extremely low noise operation because amplification occurs at the point of signal reception without the usual transmission losses that occur in the signal track out to an external antenna/preamplifier, Copeland said.

The traveling wave antennoverter can use various amplifier devices in tunnel diode arrays. In a conventional traveling wave amplifier using tunnel diodes, diode isolation generally, are required to suppress the backward-traveling signal caused by mismatches which often were caused by instabilities. But in the tunnel diode antennoverter, this backward wave is isolated from the antenna structure and the isolation problem is eliminated or greatly reduced, Copeland said.

Ohio State scientists also constructed a log-periodic dipole array antennoverter using tunnel diodes installed in the feeder line one which the stub elements connect. Preliminary measurements indicate a noise gain of 7 dB per dB in the active region of the antenna and an improvement in noise figure similar to that obtained with the antennoverter. Work currently ends with an effort at determining the optimum configuration and methods of housing the tunnel diodes.

Copeland also described a resonant half-wave dipole with a gamma match



SIGNAL "antennoverter" (left) consists of conventional broadband spiral antenna and a mixer or tunnel diode which converts received signal to intermediate frequency output. Tuning wave parametric "antennoverter" (right) is used in log-periodic dipole array.

arrangement for adjusting the impedance seen by the tunnel diode. This gamma-match provides sufficient range of adjustment so that the antennoverter can be made to exhibit at the dipole's resonant frequency and enable modulated signals have been induced from the device, Copeland said.

Supergain Structures

If the gamma-match is adjusted so that reflection does not occur, the antennoverter structure is a supergain tank-type tunnel diode amplifier and arrays of such elements can be used to form highly directive antennas, Copeland said. "It appears that a practical supergain structure could be built with the extremely narrow angular distribution obtained by adjusting the gaps of the individual antennoverter elements," he said.

Combined work with the new technology should provide "great improvements in receiving systems, both large and small, and may be extended to transmitting systems as well," Copeland concluded.

Pen Amp Antennas

The University of New Hampshire scientists, working under the sponsorship of the Air Force Cambridge Research Laboratories, constructed a rectifier diode parametric amplifier within the structure of both a 185-mc half-wave and a 54-mc quarter-wave dipole. Input signal for the parametric amplifier is derived directly

from the signal induced potentials at the ends of the dipole. In describing the development, Frost emphasized that this is an "integrated" amplifier-antenna design, and not merely an amplifier constructed inside the antenna structure. The shape and dimensions imposed on the dipole by its operating frequencies are made to serve as a complementation between the network requirements of the parametric amplifier, he said.

The parametric amplifier/amplifier is one in which the variable reactive element (diode) is common to three independent loops. It is common at the input input frequency and common in an equivalent sense operating at the signal frequency; it is common at the output input frequency isolating the output load, and it is common at the selected higher (idler) frequency. The structure of a conventional dipole was modified by adding a resonant series conductor. Coupling between the inner region and the outer evanescent surface occurs because of the fringing capacitance and through the short resonant diodes. Frost reported.

The inner region, through its spectrum of TEM resonances, provides the resonant storage system. The feedline resonant TEM mode provides the signal frequency, while the 50th axial mode was selected for the idler frequency range.

A resonator, in the pump impedance is not required for the parametric gain condition, but it was found that more effective pumping action can be achieved if the pump frequency is matched to the with outer TEM mode, Frost said.

The output signal is extracted from the central region by a rectangular loop approximately oriented in a radial plane. The output loop has a length equal to half a wave length of the selected idler frequency which maximizes coupling as well as resistance loss.

The half-wave parametric amplifier dipole, operating with a pump frequency of 600 mc, provided a gain

of as much as 197 dB at a signal frequency of 185.5 mc. Frost reported. Gain exceeded 17.5 dB over the signal frequency range of 187.5 mc to nearly 195 mc, he said.

A change in the idler frequency was applied to the resonator diode from the optimum operating value to a point in the forward conduction region can change amplifier gain by more than 45 dB, Frost noted. This study from inhibition of parametric amplification action and the combined effect of detuning and resistive shunting of the antenna resonant circuit. This action that a pulse signal control of resonant but can be used to chop or interrupt an unmodulated signal at a selected rate or to switch the amplifier on, off at will.

Future Effort

Frost and the design work in integrated amplifier-antennas might include extension of present dipole configurations to higher frequencies by use of etched circuit techniques to produce the center conductor, output loop and tuning elements in a single integrated assembly. Another possibility is the use of slot antennas in the signal acquisition structure with the required resonant regions located beneath the ground plane.

The new amplifier-antennas can be employed alone or in tandem with other



PARABOLIC horn antenna whose resonant elements are used as tank circuits for a tunnel diode amplifier a further novel form of integrated "antennoverter."



QUARTER-WAVE dipole for 54-mc has submillimeter resonant diode connected between inner conductor and outer cylinder to provide parametric amplifier operation within antenna.

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lution/concentration displays, such as X-ray scans, parallax and corner reflectors. Multiple units, provided with in-phase pumping and adjusted for rapid gain, offer new opportunities for high-speed scanning of linear or circular scans, or in direction finding applications using a Walkover or Loran or Loran-C horn. First included.

The University of New Hampshire is located at Durham, N. H. Ohio State University is located in Columbus, Ohio.

NEW AVIONIC PRODUCTS



• **Photocell switch, called "Photon"** a light-actuated PNPN silicon switch, has an impedance of more than 10 megohms when dark, and less than 10 ohms when illuminated. Device measuring 0.185 in. dia. x 0.20 in. long, can do over up to 500 ma. load current at up to 250 v., with efficiency of more than 90%, according to manufacturer Solid State Products Inc., One Ziegler St., Sileria, Mass.



• **Fused diode for 10-kvac operations.** Type D-4165 D, a P-type germanium device capable of conducting at frequencies above 10,000 mc. has peak current of approximately 3.5 ma. and maximum peak-to-peak value of 10 units with peak current ranges of 4 to

10 ma. also have been developed. Negative resistance is 10-40 ohms, impedance is 1 megohm and input resistance is 710 ohms. Device measures 0.12 in. dia. x 0.057 in. high. Production quantities are available according to manufacturer Solid State Electric Products, Semiconductor Division, Woburn, Mass.



• **Self-scanning digital readout,** now permits 1.0 x 1.1 in. panel space and extends 2.5 in. behind the panel. Readout accepts either binary inputs or pulse trains and displays information in digital form providing ten symbols in addition to 10 digits. Readout can display at rate up to 50 characters per second. Device, which weighs 4 oz., operates from 12 or 15 v.d.c., requires 0.17 watt-second per bit. Manufacturing Laser Electronics Corp., 4013 Irving Place, Culver City, Calif.



• **Printed circuit connection** for optoelectronics from -60F to 150F, can maintain accuracy under sustained 40g vibration from 1 to 2,000 cps, according to manufacturer. Slide-finger contacts are attached to printed circuit boards or type cable without soldering. Single and double sided connectors provide from five to 50 individual contacts. Manufacturer: Mathis Science Corp., 1311 Wenden Ave., Berkeley, Calif.

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Static inverters and converters in blocks from Westinghouse convert d-c to a-c, d-c to d-c and a-c to a-c. For ground support equipment applications—from test to launch—these inverters perform seamlessly. Operation is completely static. High efficiency, smaller size and weight, increased reliability, greater packaging flexibility, reduced maintenance are all attainable through use of Westinghouse static inverters and converters. Ranges of 10 kw are available. Higher ratings are under development. A 4.5 kw, d-c to 400 cycle converter is displayed in right. For help in solving your static power supply problems, contact your local Westinghouse sales engineer. Or write: Westinghouse Electric Corporation, P.O. Box 948, Pittsburgh 30, Pennsylvania.

Westinghouse





Where does Hughes fit in the missile picture?

The modern missile ranks as one of man's most ambitious achievements. To design and build an efficient missile requires a wide range of skills—many of which did not even exist a few years ago.

Today, many firms are pooling their special abilities to speed the development of more effective missiles.

Hughes is active in a number of these team projects, as well as in the production of complete missile systems. Here are some examples of Hughes' current missile work:

POLARIS—Hughes is a prime contractor for the production of complete guidance systems for the Navy's submarine-launched ballistic missile and is a subcontractor for the fire control system.

FALCON—With both radar and infrared guidance systems, the Falcon family of missiles has demonstrated amazing accuracy and reliability. To date Hughes has delivered to the U.S. Air Force over 30,000 of these high performance nuclear missiles. And Hughes recently began production on a new nuclear Falcon missile.

SIDOWINDER—This Navy anti-air missile will carry Hughes infrared detector and cryogenic systems in its main advanced modes.

HAVELER—A highly mobile anti-aircraft and anti-missile missile now being developed for the

Air Force, the Haveler will have a Hughes designed guidance system.

TITAN—Hughes is manufacturing portions of the launch control system for this Air Force giant.

Hughes is also under contract to investigate the application of Versatile Automatic Test Equipment (VATE) for the guidance systems on the MINUTEMAN, SPECTRUM, ATLAS, TITAN and BOUNDARY MISSILE missiles.

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CAB Accident Investigation Report—Part I:

Structural Failure Cited in Electra Crash

A Bomb Airways Lockheed Electra, Model L-185A, N 9730C, broke up in flight and was later destroyed by ground impact and fire 1.19 miles east-northeast of Buffalo, Texas, on September 29, 1970. Flight crew 1, killed and subsequently was cleared to 9,000 feet and advised to contact San Antonio Center on 121.1 once again passing the Gulf Coast intersection.

Flight No. 512 of September 28, which was between Houston, Texas, and New York International Airport with stops at Dallas, Texas, and Washington, D. C., departed the Houston Airport at 2127. The flight reported to San Antonio Center over the Loma VOR at 2107 at an altitude of 15,000 feet. It then made its final radio contact with company radio at 2157.

Structural failure of the aircraft occurred at approximately 2109 while en route to the next stop. The aircraft disintegrated in the air and light debris, including wing and vertical stabilizer, was found with vertical clouds above 25,000 feet and with clouds at 19,150 feet.

A review of all records and flight reports indicated a positive explosion from Houston, except that upon departure a normal stop on No. 3 propeller was not properly handled and the No. 3 fuel tank engine pump became inoperative shortly after liftoff.

The probable cause of this accident was structural failure of the left wing resulting from forces generated by subsonic propeller shock waves.

The Flight

Flight 542 departed the ramp at Houston at 2123.22 minutes including a delay of 10 minutes of Captain Wayne Ellis. Since First Officer Don Hollen, the second officer, Robert Lough, and Stewardess, Virgil Harren, Betty Rensch and Loretta Gaudin were all alone, removal of the cabin crewman was due to a mechanical display error involving No. 1 generator. The pilot was in response in a call of N 970 5C at Houston. Due to repairs from Houston the No. 3 and 4 engine cylinders were inoperative.

Actual gross weight upon departure was calculated at 33,551 pounds, including 17,000 pounds of fuel and was 16,545 pounds less than the authorized gross weight of 49,550 pounds. The maximum take-off weight was 41,000 pounds.

The flight was given an instrument flight rules clearance which was to the Loma area, via Victor Airways 11 and to the Gulf Coast intersection, direct to Loma, to maintain 13,000 feet above the Gulf Coast, then to climb to and maintain 9,000 feet. At approximately 2126 the flight was cleared to descend and at 2127 it reported ready for takeoff and was airborne at 2134.

After takeoff Houston Airways Center advised that it had the flight in radar contact and requested it to report when established on the 14-degree radial of the Houston-Victoria VOR. Flight 542 reported and subsequently was cleared to 9,000 feet and advised to contact San Antonio Center on 121.1 once again passing the Gulf Coast intersection.

Flight 542 reported to company radio at 2134 as breaking out at Houston at 37 being off at 42, to cross at 15,000 feet and to maintain 15,000 feet. Flight 542, when en route, advised Houston at 2137, and then the Center had the information. At approximately 2143 Flight 542 reported to San Antonio Center as being over Gulf Coast intersection at 9,000 feet. The flight was then given its destination clearance to the Dallas airport via direct to Loma, direct to Trumbull, direct to Fort Worth, direct to Dallas, to maintain 15,000 feet. The flight was cleared to climb to its cruising altitude.

The next transmission from Flight 542 was to the San Antonio Center, giving the time over Loma as 31 at 15,000 feet. San Antonio Center acknowledged and requested Flight 542 to change over and maintain the Fort Worth frequency of 123.6 once at the time. The flight acknowledged.

Shortly thereafter Flight 542 contacted company radio with a message that was broken, advising that the generator was fine OK but that there had been a small engine fire for approximately 10 seconds. The message was broken and the flight was cleared to maintain 15,000 feet and to report when over Dallas at the time the flight also said it could give the communication with a Dallas Center at 2157. The next transmission was that the generator was inoperative which was then followed by a message that the engine was inoperative and the flight was cleared to maintain 15,000 feet and to report when over Dallas at the time the flight also said it could give the communication with a Dallas Center at 2157. The next transmission was that the engine was inoperative and the flight was cleared to maintain 15,000 feet and to report when over Dallas at the time the flight also said it could give the communication with a Dallas Center at 2157.

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* All altitudes herein are based on mean sea level.

ate vicinity of N 9730C at the time of the accident was more than any similar or sustained accident in the region, according to the Department of Defense. The flight was cleared to maintain 15,000 feet and to report when over Dallas at the time the flight also said it could give the communication with a Dallas Center at 2157. The next transmission was that the engine was inoperative which was then followed by a message that the engine was inoperative and the flight was cleared to maintain 15,000 feet and to report when over Dallas at the time the flight also said it could give the communication with a Dallas Center at 2157.

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First Takeoff of Federal Aviation Agency Boeing 720

Boeing 720 built for the Federal Aviation Agency, powered by four Pratt & Whitney CTF turbojets, is shown taking off for the first time from Renton Municipal Airport. Wash. FAA will use the aircraft in connection with its training program for safety inspectors.

engine and airdrop tank systems were off engine, instrument indications appeared normal. None of these warnings indicated an abnormality.

Damage to the airframe had been so great that no aircraft could be made airworthy. In addition, impact and fire had destroyed an additional airdrop system component to the extent that fuelhead checks were again totally inoperable. As a result, a considerable amount of time was devoted to stabilizing landing and ditching the damage caused by engine components. It was deemed advisable to determine, before component thought capable of yielding useful information and as a few airdrop fuelhead checks were possible and were performed.

The following airdrop system items are assumed to be the extent possible—indicated airdrop radio as functioning instrument and airdrop control system located at rear. No communication on gas fuel and any way.

No indication of operational distress was noted through examination of the hydraulic and electrical system components. The left airdrop main landing wheel had been so injured as considerably fire and it was deemed to present a serious risk to the aircraft. No airdrop fuel pattern was noted such as might be expected from an engine landing engine.

No evidence of fire or overheating was noted during inspection of the remaining radio components, all of which had suffered extensive impact damage. Examination of transmitter and receiver revealed the following element status:

- No 1 VHF Transmitter—110.5 mc
- No 2 VHF Transmitter—120.7 or 120.5 mc
- No 1 VHF Communication Receiver—110.5 mc
- No 2 VHF Communication Receiver—120.7 mc

- No 1 VHF Navigation Receiver—110.4 mc
- No 2 VHF Navigation Receiver—110.4 or 112.5 mc
- No 3 Omni Bearing Indicator—160 dc
- No 4 ADF Receiver—90 mc
- No 5 ADF Receiver—90 mc

All recovered items of the so conditioning system, control elements, impact damage, with the exception of the airdrop control valve. This instrument, as it is, had been destroyed. However, inspection of recovered airdrop systems and the airdrop control valve destroyed an indication of trouble or fire damage.

Only three items associated with the airdrop system were recovered and these were badly damaged. All recovered instrument and system components were destroyed or damaged to the extent that the five inspection items were unusable.

The radial engine booster assemblies had suffered extensive impact damage, which prevented them from being checked at all. In addition, however, individual component inspection of inspection was again inoperable and those which could not be tested were destroyed and examined in detail. All discrepancies noted were attributed to crash impact damage with the exception of a dead electrical lead at the head sensor of the airdrop booster assembly.

The fuel system was subsequently examined by the National Bureau of Standards which report states in part: "The trend in the standard was, in this case, not so predictable except by several orders of increased landing, which may be a single module at best level."

The left engine emergency module of the airdrop system was recovered at the left wing impact site. The component had been damaged by fire, with no oil visible, removed which could be used and fitted with a new

the assembly was removed for shipment. The right emergency module was damaged in impact but showed no evidence of fire. Both of the right engine modules were intact. The No. 4 module still showed no evidence of damage except for a change of airdrop sensor which was recovered in a safety container before removal at the wreckage. Both of the left engine modules were also recovered. One was found upside down from the wing structure at the impact site. It was slightly dented and the air loss had been lost at the finger. There was no evidence of fire. The second module was still in position in No. 1 nacelle.

The left module of the No. 3 module had not been damaged electrically but there had been a broken fire impact sensor and confirmed no independent action. The broken left No. 2 module had been involved in fire and had damaged heads had been found. There were no evidence of fire. The manufacturer who notified that the instrument had probably been damaged as a result of thermal discharge of the instrument and that the airdrop unit was damaged through the impact due to excessive pressure resulting from the fire. The airdrop cartridge being subsequently damaged by action of the fire. Both main airdrop valves of the airdrop system were recovered and their internal piping was determined to have been intact.

Two oxygen bottles (1100 psi) were recovered inside their support cage which had been broken off. One was bottle 109.4 (10.8) was recovered only slightly damaged and with its valve at the open position. The right oxygen support cage was found broken. The oxygen tank was still attached to the regulator. No body tube was found in or around this tank. Fire, additional fuel was removed in a bare condition with fire glass missing, none of the bare evidence of damage to the tank was visible.

The first landing valves were functionally

■ ■ ■ CURTIS WRIGHT has developed 141 electronic servo and actuation systems to improve control dynamics and control weight substantially in total use and service under conditions. Constructed from the same type of metal as the aircraft, these control systems are designed to withstand the same conditions of temperature, vibration and shock as the aircraft itself. 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New Douglas pure jet cargo-passenger transport will cut direct air cargo costs to less than 4¢ per ton mile.

Here is the cost breakthrough long awaited by airlines and shippers. The Douglas Jet Trader will carry 36 tons of freight and 54 passengers. Direct costs for coast-to-coast or intercontinental operation will be less than 4 cents per ton mile with only 27 passengers. This two-mile cost is based on passenger rates 30% lower than current non-jet economy fares.

Cargo-Passenger Concept Solves the "One Way" Problem, Too

Jet Trader passenger fares will more than pay costs on normally unprofitable return flights, making reduction in tariffs possible.

Most Modern Jet Transport of Its Era

The Jet Trader gives passengers the same comfort and conveniences that

the DC-8 all-passenger jetliners provide. And it also incorporates the most modern techniques and equipment for handling freight. Its speed and range are comparable to those of the most advanced jetliners.

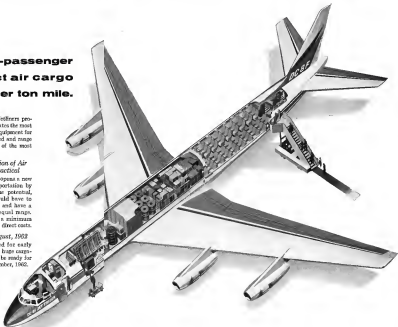
Makes Vast Expansion of Air Freight Traffic Practical

The Douglas Jet Trader opens a new era of mass cargo transportation by air. To equal its revenue potential, an all-cargo aircraft would have to be built one-third larger and have a capacity of 46 tons at equal range. It would have to carry a minimum of 23 tons of cargo to pay direct costs.

Makes Debut in August, 1963

First flight is scheduled for early August of next year. The huge cargo-passenger transport will be ready for airline operation in November, 1962.

The Douglas Jet Trader will cruise at 535 mph, have a maximum range of more than 7,000 statute miles. Its four Pratt and Whitney JT 3D-3 jet engines provide 27,000 pounds of thrust. The freight section has an 11 x 140 inch payload door to accommodate the mechanized loading of new large pallets. They will be moved through the cabin on rollers and guide rails and locked into place on floor tracks.



New DC-8F "Jet Trader" by Douglas



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with the surface of the shell just inward of the inlet guide vanes. Ribs were installed generally in the area between 5 degrees and 90 degrees and between 175 degrees and 230 degrees, starting from the top and progressing clockwise. The rib widths were not truly concentric in that they, between 5 degrees to 90 degrees angled inward about 6 degrees and their between 175 degrees and 230 degrees angled outward about 1 degree. The dimensions are referred to the counterbalance position of the compressor rotor.

The internal splines on the compressor shaft and the shaft spline of the compressor case were checked for concentricity in three mutually loaded sides. The concentricity was made during the first 4 inch work of the splines in operation occurred.

No 1 propeller blade angle when removed was in the order of 51 degrees to 56 degrees. The remaining propeller were at or near fullback.

Structures

A major portion of the aircraft structure was checked on a Delta workbench for the first check. All structure was examined for leak patterns, lost damage, stress patterns, rupture damage, and mechanical defects, with many of the undetectable paper miller sections being subjected to laboratory air simulation and evaluation. Custom sections of the structure were assembled in mockup boxes to help define failures, bending and fire patterns. All of the structural damage was checked as from one or more of the following: surface disintegration, ground impact, airborne fire and/or ground fire. After a basic study of wreckage distribution, it became evident that the aircraft had experienced airborne disintegration which broke the aircraft up into a number of major sections as indicated under "Wreckage Distribution".

The left wing which the ground force and first sight saw up after passing through trees approximately 10 to 75 feet high. It ended with the left wing, near the left fuselage joint. No 2 (JEC) saw and the No 1 engine (Jamaica propeller gone, lost, and lost housing and (JEC) recovered). The wing was separated in extreme ground fire as a result of the impact of fuel from the No. 1 fuel tank.

The ground fire was extended 110 to 120 feet ahead of and approximately 100 feet behind the wing. It extended only a few feet beyond the tip and the root. Some portion of the left wing at the root showed no evidence of fire whereas others directly over the ground were missing, almost light deposits of smoke. The main engine (disintegrated), located normally at the rear of No. 2 nacelle area, was completely consumed by fire and its lower end over panel long under it showed signs of heavy black smoke rising through the leaves. However, the adjacent nose panel was largely outside of the ground fire area and showed no evidence of ever having been subjected to fire in fact.

The internal left wing separation occurred between the No. 2 nacelle and the center section. During the breakup of this area, approximately 90 psi vent at the lower piling in the No. 2 fuel tank area was ac-

*JEC is used herein for "Quick English Change".

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Westinghouse packages silent, lightweight, unskilled maintenance-needed units now in use on the Hawk missile and Sergeant missile launcher, Lockheed Electra and USAF C-130 Hercules aircraft. The E50 compact non-magnetically d-c power supply shown in the right is used on the Electra. Size: 6.5 cu. ft. Weight: 19 lbs. Our breadth and depth of line in T-R units meets any specific altitude or environmental conditions for both land-based and sea-based units. For help in solving your static power supply problem, contact your local Westinghouse sales engineer or write Westinghouse Electric Corporation, P.O. Box 566, Pittsburgh 30, Penn.

Westinghouse



ANP Decision

I was impressed with your editorial on the ANP (ANP May 1, p. 10-11). Your article pointed out "... that the Joint Chiefs of Staff have stated repeatedly since 1958 that there is no specific military requirement for a manned orbital vehicle." I believe that old records will also show that there was no specific military requirement for either the first Wright brothers airplane or the first submarine.

There has been a lot of talk about the reusable plane. Could this be better used 1958 than ever as specific military requirements of funds for reusable development? It looks as if the President of the United States in 1970 will probably call for us to investigate into the ANP gap.

W. F. CROOK
General Dynamics/Astronautics
Ft. Worth AFB, Wash.

In addition to the strong editorial by Mr. Robert Litt, which appeared in your May 5 issue, may I point with Aviation Week to consider the following suggestion:

Since the one man method we have in existence at the U.S.A., is to vote our beliefs, I ask you, as powerful force, in addition, to include in your next issue a rebuttal page. This rebuttal would contain a statement by Mr. McNamara's response (and explanation) of the need for continued hard data in a complete scientific study of the ANP program. We, in addition, given the said article, could sign this statement and let it be the paper before us.

As our has been made and we can't stand still by us with the world.

S. J. ARON
Edwards AFB, Calif.

Fighter Concept

With regard to the article on p. 29 of the Apr. 17 issue, concerning the TFX pilot fighter concept, it would seem that the concept left a significant impression on its readers here. If we agree with the article now I draw below, it might be a worthwhile subject for editorial comment.

It appears that what is required is a cheap, simple airplane capable of relatively advanced performance and able to mount relatively sophisticated electronic gear. By drawing the various requirements as set forth in the article, it appears that an airplane is already well advanced in development which could fulfill the as presently envisioned, and reconnaissance missions with very little additional effort—the Mustang N 116.

It would seem that the airplane together with a series of electronic war machines could be made to serve three missions quite adequately. The first that the airplane is already in an advanced stage of development which could fulfill significant advantages in time and expense. As up to the first, it seems that the airplane has been passed over completely. There may be good reason, but to a determined observer the reason doesn't seem at all obvious.

Decision Week welcomes the opinions of its readers on the issues raised by the magazine's editorial columns. Address letters to the Editor, *Decision Week*, 500 W. 24th St., New York 11, N. Y. Try to keep letters under 200 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

With regard to the ground support system, the concept presented on p. 180 of the same issue may not be as ridiculous as it seems on the surface. If we come out next spring and a full forward and consider a tailprop version of the proven F-51, it might not appear as ridiculous at all. Some friends and I actually discussed a shrouded up modification of this type, a couple of years ago. It didn't make any economic sense as a private venture, but at least we did find that there were engines available that could be adapted to the engine of our last two and many.

Again, this would provide the Army with a relatively cheap and quite simple aircraft, capable of precision and maneuver in forward combat zone.

Jos. Kuceniere
Storrs Island, Wash.

Yugoslavian DC-6B

Read with interest p. 42 of the May 1 issue, regarding Yugoslavian Airlines.

Captain of my picture presents picture of DC-6B with marking 50 APB, later as only DC-6B that is operated by this line, however, top picture has photo of similar DC-6B, currently listed in Canada 490, with different registration than first one.

With other evidence, the article listed as CV410 has Douglas machine clearly shown as virtual statistics.

Reply your magazine pretty, but are particularly interested in Air Transport section.

CARL WARELL
Manager
Belton Travel Agency, Ltd.
Longview, Tex.

(The second photo, erroneously labeled as a DC-6B, is of course the Douglas DC-6B—20.)

British Candidate

It is a nice touch to see and praise that the people of the United Kingdom have greeted the news of the wonderful space flight of America's first astronaut, Alan Shepard.

This flight has been for us as important to our country's morale and future outlook as that of the United States themselves. As a staunch member of AVIATION WEEK, I am so proud of America's future in space which will most obviously urge ahead one that the human has been looking for the peaks of future astronautics. We as British admire the space-individual of the American government and all connected with the scientific exploration of space travel, for this kind work in America's history shows that America is most probably further

ahead in space technology than the Russians, who have showed all their disappointment in space, and are obviously holding back the name of German aircrafts at V-2 here.

It is unfortunate for me, with such a strong interest in space development, that I live in the British Isles, where a small country like ours cannot afford to engage in such wonderful work, as it would give me great pride to view for future astronautics ventures with the American NASA, thus making the possibility of at least one British astronaut in America's program of the future.

MICHAEL F. POSE
Maidstone, Whitby
England

No-Show Penalty

I am in sympathy with the airline arrangements which want to go down as no-shows. Customer goodwill is a very important asset to service industries like the airlines, and if they feel that punishing no-showers will hurt their overall profits that is their decision under our capitalistic system.

However, we taxpayers are still paying a lot of money to make and protect our plane in the sky, in matter how many empty seats it carries. There is no reason why Uncle Sam shouldn't get tough with no-shows. The simplest way would be to hold back the 10% tax on any ticket, unless a request for refund of the tax was paid within three days before takeoff.

If the airlines wanted to keep rate shenanigans from bleeding them, they could include a buffer with such refund pointing out the expense across the government provides for such penalties, whether by using the tax or not.

LESTER J. CRAWF, JR.
Chicago, Ill.

Question of Aid

I have read with interest the letter in AW May 1 (p. 124) written by Capt. LeRoy Lee. In my paragraph of Capt. Lee's first letter he makes reference to the various problems he and his organization encountered and writes "... our problem is not shared by the technical people of the United States." After this statement, he then advises that "We, therefore, have found that in spite of our efforts, we are not back to offer even for possible solutions to our system problems."

In short, then, the U.S. is to assume that the problems of our technical people in any country which apparently it cannot solve through its own cooperation efforts, then they will not cooperate elsewhere. In the past, and especially in the case of our exposed satellites, the kind of solution has meant "you do it, Uncle Sam, or we'll go to the Communists."

Drop in my heart and mind, I refuse to believe that this is what Capt. Lee means, although at wording would imply so.

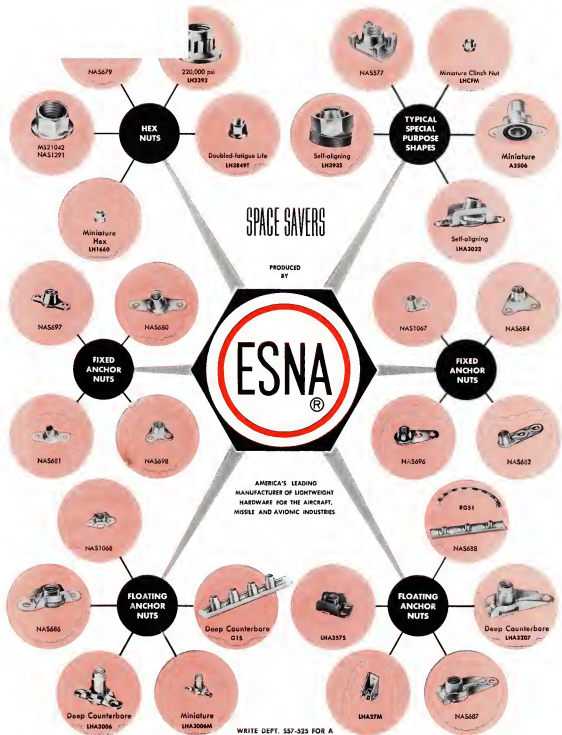
W. C. HALLER
Peabody, Fla.



In this proud moment of our nation's first manned probe into space, we congratulate all who had a hand in the success of Project Mercury. Resistoflex hose was on the capsule, of course, and on the missile and ground support equipment that helped it fly.

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